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INTERNATIONAL INSTITUTE OF AGRICULTURE
DEPARTMENT OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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This index though arranged alphabetically retains the grouping of the subjects used in the *International Review*.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *International Review*.

The index consists of three parts: one of the original articles, one concerned with Agricultural Intelligence and the last with Plant Diseases.

In case of errors in the Bulletin with reference to scientific terms and the names of authors, it should be noted that the correct spelling can be relied upon in the Index.

The Table used for the conversion of the Weights, Measures and Money values of the various countries to the Metric System is included. A list is also given of the Periodical Publications reviewed by the Bureau.

This Index was prepared by rédacteurs: Dr. Giulio Provenzal and Prof. Giulio Trinchieri, the latter compiled the Index of Plant Diseases. The whole was adapted to the English Edition by rédactrice Miss M. L. Yeo.

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IV — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS

1 Archine (Russia)	=	27 99961 inches
1 Ardeb (Egypt)	=	5 44435 bushels
1 Ardeb of wheat (Egypt)	=	2 95264 cwt
1 Ardeb of hulled maize (Egypt)	=	2 75580 cwt
1 Ardeb of barley (Egypt)	=	2 36211 cwt
1 Ardeb of uncorticated rice (Egypt)	=	5 72812 cwt
1 Ardeb of decorticated rice (Egypt)	=	3 83813 cwt
1 Arpent (Canada)	=	0 84501 acres
1 Are [100 square metres]	=	107 63915 square feet
1 Arroba (Brazil)	=	33 06951 lbs
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25 35841 lbs
1 Arroba (Mexico)	=	25 36687 lbs
1 Bale of cotton (Brazil)	=	396 83415 lbs
1 Bale of cotton (United States)	=	4 46431 cwt (gross wt.)
1 " " " " "	=	4 26788 cwt (net wt.)
1 Bale of cotton (India)	=	3 57145 cwt
1 Barrel of wheat flour (Canada, United States)	=	1 75001 cwt
1 Bar, see Millier		-----
1 Bow (Java, Dutch Indies)	=	76 36098 square feet
1 Bushel (United States)	=	0 96896 bushels
1 Bushel of oats (United States)	=	32 lbs
1 Bushel of oats (Canada)	=	34 lbs
1 Bushel of wheat and potatoes (United States)	=	60 lbs
1 Bushel of barley (Canada, United States)	=	48 lbs
1 Bushel of raw rice (United States)	=	45 lbs
1 Bushel of rye, hulled maize, linseed (Canada, United States)	=	56 lbs
1 Cadastral arpent (Hungary)	=	1 42201 acres
1 Cental (United States)	=	100 lbs
1 Centiare [10 square metres]	=	10 76392 square feet
1 Centigramme	=	0 15132 grains
1 Centilitre	=	0 0022 gallons
1 Centimetre	=	0 393715 inches
1 Centistere	=	0 35315 cubic feet
1 Centner (Germany, Austria, Denmark)	=	110 23171 lbs
1 Centner (Sweden)	=	93 71238 lbs
1 Cho [60 ken] (Japan)	=	119 30327 yards
1 Cho (Japan)	=	2 45068 acres
1 Crown [100 heller] (Austria Hungary)	=	10 d at par
1 Crown [100 ore] (Denmark, Norway Sweden)	=	15 1 1/2 d at par
1 Cubic centimetre	=	0 06102 cubic inches
1 Cubic metre	=	1 30795 cubic yards
1 Decagramme [10 grammes]	=	0 35275 oz

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Decliare [10 square metres]	=	11.95986 square yards
1 Declatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
Decillitre	=	0.022 gallons
1 Decimetre	=	0.0027497 bushels
1 Decistere	=	3.93701 inches
1 Dinar, gold [100 para] (Serbia)	=	3.53146 cubic yards
1 Dollar, gold, \$ [100 cents] (United States)	=	9 ¹¹ / ₁₆ d at par
1 Drachm, gold [100 lepta] (Greece)	=	4.1 ¹ / ₁₆ d at par
1 Dz = Doppelzentner (Germany)	=	9 ¹¹ / ₁₆ d at par
1 Egyptian kantar (Egypt)	=	220.46341 lbs
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	99.04980 lbs
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1.03805 acres
1 Franc [100 centimes] (France)	=	15.7 ¹¹ / ₁₆ d at par
1 Gallon (United States)	=	9 ¹¹ / ₁₆ d at par
1 gramme	=	0.83270 gallons
1 Hectare [10 000 square metres]	=	0.03527 oz
1 Hectogramme (100 grammes)	=	2.47109 acres
1 Hectolitre [100 litres]	=	3.52746 oz
1 Hectometre [100 metres]	=	21.99755 gallons
1 Hectostere [100 cubic metres]	=	2.74967 bushels
1 Jarra (Mexico)	=	107.36133 yards
1 Kadastral hold, see Cadastral arpent	=	130.79505 cubic yards
1 Kin (Japan)	=	7.22642 quarts
1 Kokou [10 to] (Japan)	=	— —
1 Kokou of oats (Japan)	=	1.32276 lbs
1 Kokou of cocoons (Japan)	=	1.58726 quarts
1 Kokou of wheat and maize (Japan)	=	1.55014 cwt
1 Kokou of barley (Japan)	=	82.67268 lbs
1 Kokou of naked barley (Japan)	=	2.58356 cwt
1 Kokou of rice (Japan)	=	2.06685 cwt
1 Kopek (Russia)	=	2.69428 cwt
1 Kwan (Japan)	=	2.80501 cwt.
1 Lei, gold [100 bani] (Rumania)	=	1 ¹ / ₁₆ farthing at par
1 Leu [100 statinki] (Bulgaria)	=	8.26738 lbs.
1 Lira [100 centesimi] (Italy)	=	9 ¹¹ / ₁₆ d at par
1 Litre	=	9 ¹¹ / ₁₆ d at par
1 Manzana (Nicaragua, Guatemala)	=	0.21998 gallons
1 Mark [100 Pfennige] (Germany)	=	0.0275 bushel
1 Mark [100 penni] (Finland)	=	1.72665 lbs
	=	11 ¹ / ₁₆ d at par
	=	9 ¹¹ / ₁₆ d at par

1 Maund Factory (India)	= 74.6709 lbs.
1 Maund Imperial (India)	= 82.28136 lbs.
1 Metre	= 3 28084 feet
1 Milliare	= 1.07639 square feet
1 Milligramme	= 0.01543 grains
1 Millilitre	= 0.00022 gallons
1 Millimetre	= 0.03937 inches
1 Millistere	= 61.02361 cubic inches
1 Myriagramme [10 000 grammes]	= 22.04634 lbs.
1 Myrialitre [10 000 litres]	1 = 2 199.75539 gallons 1 = 274.96701 bushels
1 Myriametre [10 000 metres]	= 6.21373 miles
1 Millier [1 000 000 grammes]	= 19 68426 cwt.
1 Milreis, gold (Brazil)	= 2 2 ⁸¹ / ₁₀₀ d at par
1 Milreis, gold (Portugal)	= 4 5 ¹⁰ / ₁₀₀ d at par
1 Minot (Canada)	= 1.07306 bushels
1 Morgen (Cape of good Hope)	= 2.11654 acres
1 Muid (Cape of good Hope)	1 = 24 gallons 1 = 3 bushels
1 Oka (Greece)	= 2.75579 lbs.
1 Oke (Egypt)	= 2 75198 lbs.
1 Peseta, gold [100 céntimos] (Spain)	= 1 ¹⁰ / ₁₀₀ d at par
1 Peso, gold [100 centavos] (Argentina)	= 3 11 ¹⁷ / ₁₀₀ l at par
1 Peso, gold [100 centavos] (Chili)	= 1 5 ¹³ / ₁₀₀ d at par
1 Pic (Egypt)	= 2 46646 met
1 Pikul (China)	= 133 27675 lbs
1 Pikul (Japan)	= 132 27605 lbs.
1 Poud (Russia)	= 30 11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	= £1 0 6 ¹⁰ / ₁₀₀ d at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	= 15 0 ¹ / ₁₀₀ d at par
1 Pund (Sweden)	= 1 33712 lbs
1 Quintal	= 1 90543 cwt
1 Rouble, gold [100 kopeks] (Russia)	= 1 ² / ₁₀₀ l at par
1 Rupee, silver [16 annas] (British India)	= 1 4 ¹ / ₁₀₀ d at par
1 Square metre	= 1 19599 square yards
1 Stere [1 cubic metre]	= 1 50795 cubic yards
1 Sucre, silver (Ecuador)	= 15 11 ¹¹ / ₁₀₀ d at par
1 Talarí [20 piastres] (Egypt)	= 4 1 ¹¹ / ₁₀₀ d at par
1 To (Japan)	1 = 0 49601 bushels 1 = 3 96815 gallons
1 Ton (metric)	= 1 98421 tons
1 Verst (Russia)	= 1 166 64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	= 25 0 ¹⁷ / ₁₀₀ d at par
1 Zentner (Germany)	= 110 23171 lbs.

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FIRST PART
ORIGINAL ARTICLES

Stock Breeding in Madagascar

by

GEORGES CARIL

Chief of the Colonization Service of Madagascar

I. GENERAL REMARKS

All those who have studied the national food problem have acknowledged, as far as regards meat, that the best remedy for the shortage of live stock is to introduce live animals or carcasses into France in as large number as possible. Attention has thus been directed to the live stock of other countries and, in particular, the colonies. Amongst these, Madagascar, with its 7 million head of live stock, is acknowledged to be one of the most important and rich, while it could at once furnish useful help to the mother country.

The opportune moment for making use of the studies and documents throwing light on the state of cattle breeding in this French colony has now come and that is the practical object of this work.

II. — BREEDING CONDITIONS

The large island of Madagascar with its immense steppes, its grassy brush on hills of red or stony soil which cover nine-tenths of its area, represents a type of country for intensive pastoral stock rearing. Rearing in fields or buildings is as yet the exception and is only carried on in plantations in order to maintain draught animals.

Breeding districts and regions. — A breeding district is one with natural meadows ; it depends solely on these and it is all the more remunerative and prosperous as the quality of its meadows is greater.

The natural meadows of the island can be classified in different ways, according to the soils on which they grow or according to their botanical composition. But no matter what classification be adopted, the predominant character of the Madagascar steppe is given by the small number of species, mostly cosmopolitan ones, that make up its composition. What was the cause of this uniformity ? What was the original cause that was so persistent as to maintain this same character in that formation in spite of differences of soil, in spite of time ? Why is it that, in our opinion, everywhere the grass is gradually becoming rarer, the bare ground gradually increasing in area ? A consideration of the origin of the steppe will provide us with the explanation.

The coming of man into the island was marked by intense and continuous deforestation ; the disappearing forest was replaced by grass land which, drying up each year, caused the spread of fires ; the extension of the cleared areas has been followed by the extension of the grass-land zones and, in consequence, that of fires. It is owing to fire that nine-tenths of the island is now grass-land ; it is fire that maintains that special composition, with so few species. The only plants that have resisted the fire are those that can support the loss of all their aerial parts and which can reproduce without seeds or are capable at least of living and reproducing while resowing themselves only at long intervals, the prairies species have then been all chosen and selected by fire.

Precise observations enable us to suggest that

1) Wherever the grass has been pastured or cut at the end of the rainy season, especially along the roads followed by herds when changing pasture, the grass grows again as soon as the dry season begins

2) Certain grass-lands that are specially cared for by the natives and which, without being owned by individuals, are pastured collectively by well determined villages, are not burned and a casual fire is often put out by the villagers themselves.

3) Fire is the only means of regenerating ownerless grass-lands employed for no definite purpose, any other method of improvement would need special more difficult operations, causing more trouble to the villagers, herdsmen, etc. Who would gain from such operations ? In the present state of the laws of Madagascar it does not follow that those carrying out the work would reap the benefit. The first thing to be done, therefore, is to expropriate and assign the pastures ; this preliminary operation is required before attempting to begin the improvement of Madagascar grass-lands.

Crop-growing regions. — On the contrary to the previous formation, the regions where intensive breeding is carried out are above all crop-growing regions, that is, those where labour and the general expenses for a given area are high. Stock are rarely bred, but if so they are reared for everything they can produce — fattening, work and milk. The grass alone does

not suffice as food, so richer and more concentrated foods have to be grown, such as manioc, maize, peas, groundnuts, rice, etc.

Live-stock reared. — All the domesticated animals are to be found in the island, but the cow will long be the most diffused, the most valuable and best suited to utilise the special brush of the island.

The Madagascar cow is really a zebu and it might be developed into a special breed although it is not native to the island. It is a brachycephalous animal of more than medium size, and has a more or less large hump on the withers. It has long horns, shaped like a lyre; the neck is slender and the dewlap well developed, the proportions of the trunk are shortened; the front quarters are ample while the rear is somewhat defective and narrow, but the legs are slender and the skeleton light. The coat is a more or less dark tawny colour, often piebald, the skin is thick, the coat harsh.

The Madagascar breed, on account of its small size, is very different morphologically from our European breeds. The average height of the cow is 47 in. varying from 44 to 49 in.; the bull is 49 in. high on an average, reaching as much as 76 in. Small parents naturally only produce bullocks of low weight.

The qualities of the Madagascar cow are all centered in the trunk and, to be more precise, in the fore quarters. The fore quarters are well developed, the chest is ample and reaching down well between the legs, the sides are well arched, the shoulders very separated, the thoracic perimeter sufficiently long, the back very straight. The legs are sometimes short, which is an absolute quality, as they are of no commercial value.

The defects should be studied carefully as they must be very exactly known if they are to be eliminated in future breeding. We leave petty defects, such as too great development of the horns, too great importance of the neck, on one side and confine ourselves to undeniable defects.

In Madagascar the animals have too short a trunk, and too long a rump, while the legs are often not long enough. A beef animal should have the trunk as long as possible, the rump very long and wide, with the legs reduced to the absolute minimum. The figures given below show that characters absent in the two parents cannot be obtained in the bullocks.

The length of the trunk, measured from the point of the shoulder to the point of the buttock measures from 49 to 64 in. in the bull, with an average of 57 in., and in the cow from 48 to 58 in. with an average of 53 in., or 112 to 113 % of the height in both sexes.

The chief defect lies in the poor development of the rump. This is too short, too narrow, the sacrum is raised, which gives a pointed rump and the thighs are too close together, with too little muscle. No European breed has such a short rump as the Madagascar breed.

Madagascar cow average height				rump length	17 in	56 %	rump size
»	»	47 in.	»	»	»	18	» 38 '0 » »
Tarentaise	»	66.7	»	»	»	21	» 46 '0 » »
Durham	»	67.2 in.	»	»	»	27	» 49 '0 . » ' »

The width of the rump may be said to be, on an average, 86 % of the length of the male and 91 % in the cow.

Therefore, Madagascar cow	width of rump length of rump	$\times 0.90$
Tarentaise »		$\times 0.94$
Durham »		$\times 0.98$

and, for certain cows, from 100 to 110 %. In conclusion, as the Madagascar animals have neither a long trunk, nor a long, broad rump, their progeny would not possess these qualities.

Now first class meat is almost entirely located round the rump, on the back and round the kidneys ; the Madagascar breed, therefore, carry less than the European breeds and this is their weak point.

From the standpoint of physique, the Madagascar animals have undeniable, absolutely remarkable qualities. Their facility for fattening is astonishing, as is their resistance to bad weather and drought. It is well known that the herds resist the tempests during the rainy season, and that during the last two months of drought they remain in condition, provided plenty of running water is available as well as the dried stubble of the tall grasses and a few, rare verdant pastures. The resistance of the breed largely compensates for its morphological defects, which, however, can be eliminated.

To increase the milk yield crosses have been made with European animals and have produced humpless stock. These animals are to be seen in the neighbourhood of Tananarive and the towns in the centre of the country.

Pigs are very numerous on the upper plateaux, especially in those regions where the climate and soil allow the potato to be grown.

The Madagascar sheep belongs to the " fat-tailed " type found in Asia and Africa. They have no wool and are covered with more or less long hair. Continuous crosses made at Tuléar between native ewes and merino rams have shown that the breed can be rapidly changed and improved under good conditions. The climatic conditions in the south of the island, the absence or mildness of the winter, the rarity of rain are favourable to sheep breeding.

Horses are also reared, chiefly on the upper plateaux. This is the result of the work of the Veterinary Service. Owing to it some thousands of horses used for carrying men have been produced in the districts round the chief towns in the centre of the island. We will say no more about the horse than about the ostrich, as it is a question of imported species not yet acclimatised and whose success immediately depends on the extension of crops that can be taken up.

Cattle breeding is, and will long remain the basis of the wealth of the island of Madagascar.

III. — UTILISATION OF THE PASTURES AND STEPPES BY THE CATTLE.

Native methods of rearing. — It is difficult to describe the methods, customs and habits of the native and few have tried to do so. It is certain that the herds receive the minimum of care ; yet, certain beliefs and

customs which the native respects and observes without understanding them perhaps, are favourable to the good maintenance of the herds. Speaking generally the formation of a herd is the best way for the Madagascar native to invest his money. The profit, that is the increase of the herd, is consumed in feasting and family festivals.

How are the herds appropriated? How are they watched? What is the increase in the native herds? We have little information on these questions. It is usually admitted that the yield of a herd is not high; this is chiefly due to losses of young animals and to the lack of early maturity.

Various authorities have calculated the number of head of live-stock is 7 000 000, giving the number of 420 000 head available per year, of which 300 000 would be consumed by the population of the island. The 120 000 head available are at present utilised by 5 works which prepare tinned foods and frozen meat. The number available would increase as the herds increase, an increase which it is allowed could reach 3 % of the total number. Some 200 000 head would be annually available for the needs of France.

The works dealing with live stock are situated in different parts of the island. Two are at Diego, at the extreme north of the island, one near Majunga, at the mouth of the large river Betsiboka, one at Tamatave, and one near Tananarive. The number of cattle slaughtered in 1911 by these works was 14 800, increasing to 109 691 in 1916 and 140 000 in 1917.

The hygienic state of the herds is usually fairly good. There is no need to struggle with the great epidemics such as have devastated the South African herds. Tuberculosis is frequent in the herds in the south of the island where it is endemic. Bacterial anthrax causes some losses, but it can be controlled by anti-anthrax vaccination with Chauveau serum which, of late years, has given very good results.

We will attempt to define by a few figures the results obtained by native breeding, which will form a sort of point of comparison to enable us to see what is to be avoided and what must be done to obtain better results.

The census that we quote was carried out by the veterinary surgeon Rouquette, and dealt with 41 villages, 14 of which have herds of 50 to 100 cattle, 14 of 100 to 200, 9 of 200 to 300 and 4 of 300 to 400.

Cows and heifers	7 108
Calves of less than 1 year	2 874
Calves of 1 to 2 years.	1 926
Bulls of 2 years.	1 097
" " 3 "	703
" " 4 "	298
" " 5 "	36
" " 6 "	8
Bullocks	1 062

Total 15 112

Percentage of 2-years old bulls	7.25 %
» » bullocks	7.00 %

Percentage of bulls of 2 and more years :

Bulls 2 years	15,4 %
» 3 »	10 %
» 4 »	4 %
» 5 »	0,5 %
» 6 »	0,1 %

This table shows that the mortality of young animals is greater than is generally supposed. Out of 7 108 cows or heifers there are 2 874 young ones ; now, out of this number of cows about 1 000 heifers have produced no calves and there remain 5 000 to 6 000 cows giving 2 874 calves. Cows over 2-years old give a birth rate of 80 % ; there is, therefore, a mortality of nearly 30 % in the young animals under 1 year old. This mortality is caused in the rain season by septicaemia originating at the navel. In the dry season the mortality affects young animals born between May and September. Calving at that period is a calamity for the Malagasy breeder, who has skeleton calves overrun by parasites and mange.

The same table also shows the exaggerated number of bull calves and bulls as compared with the number of cows (about 30 %). But the number of 5 or 6-year old bulls is insignificant. If it be remembered that the census was taken before the period of castration, it will be seen that, at the time of service, i. e., December-January, the 5 and 6-year old bulls will be castrated as will be most of those of 4 and 3 years (3 year bulls 10 %; 4 year bulls 4 %). Only the 2 year bulls remain then and a small number of 3 and 4 year bulls.

The bulls that remain are not usually the finest. The Malagasy breeder suffers from the lack of adult bulls, from the lack of selection of breeding animals, and from the enormous losses in young stock caused by the dry season. Competition for bulls of 5 or more years would be much more useful than the fat stock competitions that are held everywhere. The Malagasy obtains fine bullocks by castrating fine bulls, which is an absurd practice. On the contrary, the owner of fine bulls can be sure of having fine bullocks later on.

All the speeches and exhortations possible do not change this state of things in the slightest ; in the beginning one must start on good bases, which the native breeders will always admit with difficulty. Could the natives improve their herds within a short time ? It is not to be thought of, as our action on them is slow and is only effective as far as it shows an example. If they have the attraction of the profit they desire, certainly the greatest possible, they have not to run the risk of losing their capital as it is very small. They lose rather because they do not make a profit.

In certain regions with more developed crops, intensive breeding by the native has already acquired a certain importance. The animals, gener-

ally few in number, are reared in pits where they remain until sufficiently fat for sale. They are fed on native crops or their by-products (leaves and tubers of manioc, potato, foliage of beans, etc.).

European methods of rearing. — Our action on native rearing can only take effect at a late date. A surer and quicker change would be obtained by the intervention of Europeans who alone can carry out the number of experiments, fruitless tests necessary to know and define clearly the methods of extensive rearing, for it is a question of extensive rearing; it is the only way in which the immense, relatively poor spaces, so difficultly accessible, that cover eight-tenths of the island can be utilised.

What is meant by extensive rearing or rearing in freedom? It implies rearing the animal as much as possible in its natural environment; it develops naturally at those points where the breed under consideration can do best under the conditions of a life of freedom. These points are regions with natural grass-lands. The difficulty for the Europeans, who have not the spirit of observation as developed as the native, Sakalave or Tsimihety breeder, or who at least have been unable to exercise it so long as they, is to choose this suitable environment and to fix clearly the corresponding points.

Rearing in freedom is practised in all countries with a low density of population and where the value of the soil and that of animal products — milk, labour — are relatively low; it is characterised by a reduction in the labour. It is the exploitation of the natural riches of the prairie of varying value, by means of a machine that utilises it more or less well (beef, mutton), by means of expenses (labour, general costs) that are extremely reduced in relation to the crude product. The net product should then be high in relation to the expenses; but only if the factors of the undertaking — the prairie and live stock — have been well chosen. The animal chosen is nearly always the native one and, therefore, the result of the affair depends on the choice of the grass-land. But the labour bill must be reduced still further; this is a second difficulty for the Europeans, who have to struggle with the native.

To sum up, the question of extensive rearing depends on . . .

- 1) Choice of pasturage.
- 2) Possibility of carrying on with less labour (1).

This extensive rearing is thus clearly differentiated from the specula-

(1) At present our studies on feeding and rations throw little light on such a speculation. The creation of artificial pastures can only with difficulty be an economic operation.

p the crude product
 b the profit
 r general expenses
 m labour

/ for an area S

Then $b = p - (r + m)$. By laying down these grass lands r and m are considerably increased and p must be increased. It is necessary that the total profit $b' = p' - (r' + m')$

tions regarding live stock that might be undertaken by the agriculturists. -- For the latter, the breeds reared in freedom that produce beef animals may produce animals unsuited for work on account of their build (as with the zebu). Thus, it may suit the farmer better to breed a type of animal corresponding to his requirements although it will cost him more than an animal reared in freedom.

Another factor of the greatest interest to the farmer is the manure; for long cattle were considered as a necessary evil for the production of manure on European farms; they were not considered as a source of profit in themselves for the farm. The low price of the products (milk, meat) and the ignorance of rational methods of exploiting live stock had the result that the live stock account was considered as a loss, balanced by the value of the manure. Nowadays it is no longer like this and livestock managed rationally always gives a profit, apart from the manure they produce.

In Madagascar everything has yet to be learned and done as regards live stock; there are farms where live stock is regarded as the necessary evil for the production of manure which is often very neglected; on other farms the stock provides valuable help when used for haulage and cultivation (Mangoro-Sambirano). On such estates the draught animals required represent such a value that they make it worth while to grow special crops to feed them; they often utilise by-products of crops or agricultural industries which can provide part of their food while otherwise being of no value. But these operations come in the sphere of intensive culture with high yields per unit of area.

This long digression is intended to show that the two systems of rearing, extensive pastoral rearing and intensive rearing and all their intermediary stages have their place in Madagascar. Either system may be profitable, and the choice of one or the other system depends on certain conditions the chief of which are certainly the means of communication and then labour. These are not two different systems between which the speculator can choose; they are only the results of well determined environmental conditions.

On the day when the various regions of Madagascar will benefit from a fairly equal distribution of the means of communication, the dominating factor fixing the position of the rearing district would be that of the possibility of fertile natural prairies resulting from the soil and the geographical position.

One of the first requirements for starting a paying concern is to own vast areas for carrying out rearing and not fattening. Some 5 000 head of stock

should be greater than b since the capital involved becomes greater. In the first case and under present conditions at Madagascar, one can also make $p = p'$.

It is sufficient to have S sufficiently large, while it is not always possible to enlarge S indefinitely in the case of artificial grass-lands.

Thus it is evident that even if the creation of artificial grass-lands were both paying and possible, it would give no advantage in starting a rearing business as long as the density of the live stock h is not become too great in relation to the area available for the business.

require a capital of 200 000 francs, or 100 000 francs for buying the cows and 100 000 francs for setting up the pastures and for running expenses for the first five years. An area of 12 000 hectares of grass-land would be indispensable.

As the area is fixed according to the value of the pasture, the number of cattle to be bought can be calculated. This number will be less than that which the pasture can really support, as the area is calculated for the maintenance of the cows and their products. During the first few years the grass can be used for fattening the more or less young stock bought from the native owners. Once the farm is stocked, the buildings required will be few in number; besides the house for the Director, buildings for the native workmen, a dipping-bath for killing ticks and watering places will be required.

As much time could be taken up in discussing the management of the herd, the question may be summarised as follows: folding is useless; cattle to be isolated after calving, make up herds of animals of about the same age; select breeding animals by castrating the males; keep a certain proportion of bulls in the herd (1 bull for about 50 cows), if possible avoid calving during the months towards the end of the dry season (August-November).

The herd may be improved by crossing and selection. The introduction of new blood is very delicate and should be calculated as both costly and difficult. The preparation of half blood animals should be provided for in a separate estate where the imported bulls could be housed and given suitable food. The half-bloods obtained should only be placed with the herds that run free. It will be advisable to return to these questions later.

Good management of the herd and an infusion of new blood should, as a first result, increase the early maturity. This character can only be maintained and fixed when the period of arrested growth due to the lack of sufficient food between June 15 and October 15 is suppressed. This can be obtained by improving the pastures and forming reserves for the dry season.

The improvement of the pastures can be expressed in one word -- mowing. And this can be best done by the animal's teeth. At present the pastures are burned, and if we again deal with the question of brush fires it is only because it is not yet completely and generally understood and if we continue to discuss it, a clearer explanation may possibly be arrived at. Under present conditions brush fires are necessary. It is certain that, for ¹⁰ of the pastures, if they were not burned, the grass would not grow again or, at any rate, the animal would be unable to eat it on account of the stubble being too hard and of too poor food value. On the other hand, the fires destroy insects, especially ticks which, at a certain period of the year (July-August) mount to the tops of the grasses to await the approach of some mammal (man, dogs, cattle) to which they can attach themselves.

But as long as the pastures are burned, their botanical composition cannot be improved, and the leguminous plants in particular, which are dwarfed and hidden among the thorny scrub, cannot spread. The very much itself, having a vegetative apparatus which, on the contrary to certain grasses, cannot adapt itself to being burnt, disappears.

Mowing, by preventing the formation of stubble allows the grass to grow again and improves the pasture. It produces the same results as fire and allows other species to multiply and spread. Mowing by machinery is obviously impossible on such immense pastures and can only be done by the animals themselves, by dividing the pastures into plots into which the animals are turned in measure as the grass is cut down to the soil. This proves the necessity of dividing the pastures into fields by fences, as is done in South Africa and Australia. This will also be the Malagasy breeders' method.

This system has the advantage that all the fodder growing on the pasture can be turned into meat without allowing it to be lost in smoke. At the beginning, hand mowing should be used as an auxiliary on a small scale and a food reserve in silos should be formed; the operation is simple and economical.

The systematic destruction of ticks by dipping (described in the *Bulletin économique*, 2nd. Half-Year, 1912) is a necessary operation. In South Africa the operation costs about $\frac{1}{2}$ d. per head and per bath for larger herds.

All these operations that are so essential in rearing merit further consideration, space for which is not available here; we have summarised them so as to show that they form an ensemble of work requiring great practical skill and a high power of observation and judgement. Can we as yet find them in the native rearer? Certainly not.

IV. — ENCOURAGEMENT REQUIRED FOR BREEDING.

The riches represented by the Malagasy herd should be utilised as well as possible, the native production must be increased and European production must be started. The measures required to obtain the best possible utilisation of the Malagasy live stock can, therefore, be classed under three heads.

1) *Utilisation of the existing live stock.* At present live stock is bought in most places in the high plains, either by representatives of the works or by middle-men who bring the cattle to the works. This is of no importance provided that our desired aim is attained. On the one hand, the native producer should be adequately paid for the goods he sells, while, on the other hand, the live stock bought by or for the works should travel from the buying place (usually the high plains) to the place of utilisation (the works on the coast) under the best possible conditions, avoiding losses and decreased weight in the living animals so that the works may receive the largest number of animals as regularly as possible.

These conditions could be obtained by the combined action of the Administration and the industrial leaders in the following way: —

The animals should be bought from the native rearers (either by the Administration or by commissioners) and concentrated in specially chosen rearing pastures. In these chosen pastures the herds could be kept until such time as they could be transported under suitable conditions. In fact

animals in condition can only be shipped on land from March till June owing to the state of the rivers in the rainy season or to that of the pastures in the dry season. The animals would be partly sent direct to the works, the remainder being kept on estates near the coast until wanted by the works. These coast estates would be chosen as near as possible to the works, always taking into account the fact that it is always possible to ship a cargo of cattle in a few hours from any point on the coast to one of the two ports (Majunga or Diego), where the most important centres of consumption are situated. These estates should be chiefly placed in certain valleys on the west coast that are flooded during the rainy season but which are covered with abundant grass as soon as the waters have gone down. These pastures remain green throughout the dry season, especially if they are eaten down by live stock.

The maintenance of the herd in these estates, the transport of the animals by certain routes, specially provided with stocks of forage, would be incumbent on the Administration, which would thus be of great service to the industrial leaders who would thus be sure of regular supplies for their works.

This scheme is only indicated sketchily and could be modified so as to suit any practical considerations.

2) *Encouragement to native rearing.* — The best, surest and most efficacious encouragement would be given by increasing the buying price of the cattle, providing safety in the transactions which are naturally falsified by the too numerous middlemen, and the suppression of the losses and depreciation in the cattle owing to transport.

All those measures tending to help the native to form better habits regarding the care of live stock, the improvement of the breed by selection, castrating the young animals, would be of more effect. These measures would be the work of the veterinary surgeons, the heads of districts during demonstration and educational tours to be made in the breeding regions.

3) *Encouragement to European breeding.* — The conclusion drawn from the preceding observations shows that breeding, owing to the low price of live stock, pays Europeans but poorly. However, it is only the Europeans that can assure a regular supply, both as to quantity and quality, in the future to the works. Facilitations should then be given them for installing and organising rearing concerns by providing the land required.

The methods used in these concerns should be deduced from what has been done under similar conditions in other countries, while taking into account the customs of the country and the mentality of the inhabitants. As regards this the collaboration of the Administration will be necessary.

SECOND PART
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT
OF
AGRICULTURE
IN
DIFFERENT
COUNTRIES

1 - **Agriculture in Burma.** -- ADAMSON, 'H, in *The Bulletin of the Imperial Institute*, Vol. XVI, No 1, pp 40-79 + 1 Map. London, January-March, 1918.

The plains of Burma comprise 3 zones, a wet zone covering nearly the whole of Lower Burma, with rainfall varying from 70 to 200 in., a dry zone extending from the border of Lower Burma north through Upper Burma to the latitude of Shwebo, with a rainfall varying from 25 to 40 in., and north of this another wet zone, with a rainfall varying from 60 to 100 in. The Uplands to the east of Lower Burma have a rainfall varying from 40 to 60 in., and a soil capable of yielding many of the products of a temperate zone, but hitherto undeveloped. To the west and north of Upper Burma lie the Chin and Kachin Hills, of no agricultural importance. Cultivation is carried on by native industry, and almost entirely under native ownership of the lands, or by direct lease by the State to the cultivator, in small farms unless the applicant requires land for special staples such as rubber, tea or indigo. There are few holdings of more than 1 000 acres. The chief difficulties hindering agricultural development in Burma are: -- the lack of means of communication (there are only 1 598 miles of railway and 2 100 miles put down on paper as metalled roads, but really only fit for bullock-cart traffic); scarcity and high cost of capital (the rate of interest is never less than 20% and often reaches 50%); cattle disease. Attempts have been made to cope with the last 2 difficulties by establishing co-operative credit societies and cattle insurance societies.

The Agricultural Department of Burma has an institute and experimental farm at Mandalay and 7 experiment stations in different parts of the province. Its work includes seed selection, seed distribution, the experimental introduction of new products, agricultural education, the introduction of improved agricultural implements (of which a stock is kept for sale to cultivators), the control of diseases and pests of plants, analyses of field cultures and manurial tests, the conveyance of agricultural information to the public, the publishing of bulletins on various subjects.

The cropped areas in the plains for the year 1916-17 were : — *Cereals* : rice, 10 569 821 ; wheat, 47 580 ; millet, 751 564 ; maize, 170 285 ; grain, 68 429 ; other cereals, 64 550 acres ; *Oil seeds* : linseed, 458 ; sesame, 1 216 772 ; rape and mustard, 3 306 ; groundnut, 261 378 ; other oil seeds, 116 acres ; *Condiments* : chillies, 77 195 ; onions, 20 972 ; various, 3 560 acres ; *Sugar* : sugar cane, 18 136 ; toddy tree groves, 22 651 acres ; *Fibres* : cotton, 223 401 acres ; other fibres, 607 acres ; *Dyes* : indigo, 263 acres ; *Drugs, narcotics, etc* : coffee, 81 ; tea, 1 799 ; tobacco, 73 722 ; betel vine, 5 337 ; betel nut, 33 815 ; other narcotics, 75 acres ; *Odder crops* : 84 651 acres ; *Beans and pulses* : 664 817 acres ; *Vegetables* : tomatoes, 17 952 ; other vegetables, 39 462 acres ; *Gardens and orchards* : 426 997 acres ; *Miscellaneous food crops* : 9 850 acres ; *Rubber* : 59 257 acres ; *Other non-food crops* : 92 220 acres ; *Total cropped area* : 15 041 079 acres.

The following are the export figures of the most important by-products of agriculture for 1915-16 : — Rice bran and meal, 249 218 cwt. ; fruit and vegetables, dry, salted and preserved, 21 203 cwt. ; vegetable oils, 393 332 gallons ; oil cake, 850 351 cwt.

The area cropped during 1916-17 more than once was 626 553 acres, and the current fallows 3 937 786 acres. The area officially returned as culturable waste, exclusive of reserved forests, was 23 336 435 acres, and included grazing land, land unsuited for rice cultivation and on which no other produce has yet been attempted, and land that could be cultivated only by large expenditure on bunds. Less than 9 % of the cropped area is irrigated, the gross irrigated area being 1 304 403 acres of which 490 344 acres are irrigated by the large Government canals in Mimbú, Mandalay, Shwébo and Kyaukse districts of Upper Burma. The Northern and Southern Shan States, covering an area of 52 000 sq. miles, are not included in the above-mentioned cropped area. In this tract the crops mentioned above are grown chiefly for home consumption ; potatoes and tea flourish there and are exported. This tract contains much waste land which is suitable for wheat and other crops of a temperate climate. In the states adjacent to the Chinese frontier the opium poppy is largely cultivated.

Hillmen throughout Burma practise a very destructive form of cultivation called " Taungya ". They migrate from year to year, clearing, burning and cultivating patches of hill forest and cause much damage to the forests.

Unless otherwise stated the following statistics refer to the year 1915-1916.

Rice. — This crop occupies over $\frac{2}{3}$ of the cropped area. The estimated yield is 1,150 lb. of paddy per acre. The total outturn of unhusked rice in 1916-17 was 6 213 000, and the surplus available for exportation was 2 700 000 tons of cleaned rice. The land is kept continuously under rice, rarely with a season's rest. Manure is only used in the plant nurseries.

Sesamum. — Early sesamum sown at the beginning of the rains and reaped 3 months later covers 855 530 acres, and is often followed by a second crop of millet, beans or rice. Late sesamum sown a few months later covers 361 242 acres. Sesamum is confined almost entirely to the dry zone. The average outturn is 200 lb. per acre. The oil extracted by crushing is

used for cooking and the oil-cake as food for cattle. Burma does not supply her own needs in this commodity, but imports a yearly average of 150 000 cwt. of sesamum seed and 30 000 gallons of oil.

Millet. — Red millet (*Sorghum vulgare*; in Burmese, *kumpyaung*) occupies an area of 462 880 acres and white millet (Burmese, *Sanpyuung*) occupies an area of 203 257 acres. The latter produces a grain used as food in the uplands. Another variety, little millet (*Panicum miliare*; Burmese, *Lu*), covers an area of 85 427 acres and is also used as food. The average yield of millet is 450 lb. per acre. The export figures vary greatly from year to year, sometimes exceeding 250 000 cwt.

Maize. — This crop occupies 155 218 acres in the dry zone and 15 067 acres in the wet zone. The yield per acre is 4 500 cobs or 700 lb. of grain.

Wheat. — The area under wheat is all in the dry zone, the yield being 600 lb. per acre. The export of wheat is insignificant; the average annual import, chiefly from India, is 100 000 cwt. of grain and 400 000 cwt. of flour.

Beans. — There are several kinds: — white beans (*Phaseolus lunatus*), red beans (*P. lunatus*), "peyin" (*P. calcaratus*), and Goa bean (*Psophocarpus tetragonolobus*). The last-named is grown mainly for its swollen, edible roots. Beans are chiefly grown in the dry zone. The outturn per acre of white beans is 600 lb., and of red beans, the principal article of commerce, 800 lb. The exportation varies from 33 000 to 63 000 tons according to the year.

Ground nut. — Grown mostly in the dry zone. The yield is 1 000 lb. per acre. The oil is extracted and as much as 300 000 gallons is exported while over 600 000 gallons are imported.

Cotton. — Cultivated mostly in the dry zone. The staple is somewhat short. The yield is 125 lb. of cleaned cotton per acre. There are enormous annual imports of cotton yarn and goods, amounting in value to £4 000 000.

Gram. — Grown almost exclusively in the dry zone. The yield is 400 lb. per acre. The home production has to be supplemented by imports.

Sugar. — This is grown in small areas in most districts of Burma, the juice is extracted in wooden presses, and is converted into cakes of brown sugar. Much brown sugar is also made from the juice of the toddy palm (*Borassus flabellifer*).

Tobacco. — Grown in all districts in Burma in small patches on the rich alluvial deposits left as mudbanks on the bends of streams, when the water falls after the rains. An acre of land is said to produce 8 cwt. of leaves. The leaves and stalks (both utilised) are sun-dried. From 8 to 23 million lb. of unmanufactured tobacco is exported, while 20 million lb. of unmanufactured tobacco is imported annually from India.

Chillies. — Grown as a field crop chiefly in the dry zone. The average yield is 1 600 lb. per acre. The imports (about 4 000 000 lb. a year) usually surpass the exports.

Tea. — Grown in a small area in the Upper Chindwin and Katha districts, but is much more extensively cultivated in the Northern Shan States.

The leaves are picked in the third and fourth year. There are 2 methods of preparation. In the first the leaves are sun-dried and then steamed. The leaves are thrown into brick wells and weighted down. There they ferment; producing pickled tea or letpet. In the second the leaves are steamed and compressed, then loosened and spread out on mats to dry. This is dry tea or letpet chunk.

Betel nut and Betel vine. - The betel palm (*Areca Catechu*) is found chiefly in the wet zone and the betel vine (*Piper Belle*) in all districts. The average import of areca nut is 42 million lb., and vastly exceeds the export (about 2 million lb. per annum).

Rubber. - This crop (*Hevea*) was hardly known until 12 years ago. It is mostly grown in Tenasserim Division, where the soil and climate are very suitable for its growth; its development is hindered by the lack of means of transport. The exports of rubber are steadily increasing; in 1916-17, 20 546 cwt. were exported. *Ficus elastica* is found in considerable quantities in the Hukawng Valley. The hillmen extract the rubber by incising the bark; they often tap the roots as well, thus killing the tree. Some 36 000 lb. are brought in annually.

Orchards and gardens. - About one-half of the area is returned as mixed gardens, with about 1/4 as plantains, followed in order of importance, by mangoes, coconuts, oranges, etc.

Forests. - The forests of Burma are more remunerative than those of any other Indian province. They provide the world's requirement of teak (*Tectona grandis*) and include 28 567 sq. miles of reserved forests and 118 755 sq. miles of unclassified forests. Even in unclassified forests teak has always been recognised as the exclusive property of the Government. During the year 1915-16, 319 256 tons of teak valued at £171 000 were sold. The outturn of timber other than teak for the same period was: Reserved trees: pinkado (*Xylia dolabriformis*), 50 934 tons worth Rs 443 240; padank (*Pterocarpus macrocarpus*), 682 tons worth Rs 59 079; kanvin (*Dipterocarpus turbinatus*), 14 311 tons worth Rs 71 574; pyinma (*Lagerstroemia Flos-Reginae*), 4 481 tons worth Rs 10 881; other reserved trees, 15 484 tons worth Rs 96 597. Unreserved trees: - in (*Dipterocarpus tuberculatus*), thitya (*Shorea robusta*), ingvin (*Pernacme suaveis*), 89 927 tons worth Rs. 297 950, other unreserved trees, 111 482 tons worth Rs. 11 78 945; giving a total of 290 301 tons worth £78 600. Other useful timbers, so far little exploited, are: tankkyan (*Terminalia tomentosa*), Pinle kanazo (*Heritiera minor*), Yemane (*Gmelina arborea*), thingan (*Hopea odorata*), manawga (*Carallia interregina*), and thitkado (*Cedrela Toona*). In 1915-16 the output of fuel wood was 632 273 tons worth £26 600. In the same year the minor forest produce was worth £68 146, including £17 261 for baniboos, £15 323 for cutch, £24 211 for grazing fees, and £11 000 for other articles amongst which (besides *Ficus elastica* rubber, which grows wild) are: thitsi (*Melanorrhoea usitata*), found abundantly in the drier forests up to an altitude of 3 500 ft., and attaining up to 50 or 60 ft. in height with a girth of 9 ft. when full grown; on tapping the tree exudes varnish which forms the principal constituent of Burmese lacquer; the annual extract is about

1,50,000 viss of 3.6 lb. — cutch (*Acacia Catechu*) ; natural reserves of cutch forests have been formed ; it is used in tanning and dyeing ; in 1915-16, 8 526 tons of cutch were exported. — *Bamboos*, growing in profusion in the Forests of Burma and used for innumerable domestic purposes ; large scale trials made at the Titaghur Paper Mills (Bengal) have shown that bamboo pulp is suitable for making high quality paper ; a concession for the extraction of bamboos for this purpose has been granted. — Mangroves and other trees with tanning bark. — *Lac*, found in large quantities in many parts of Burma, in 1915-16, 9 439 tons of lac were exported. — In (*Dipterocarpus tuberculatus*) and ingyiu (*Pentacus suavis*) produce a clear resin used for caulking boats, etc., and a thick oleo-resin used for torches ; these products, known as "endwe", are largely consumed in Burma ; an output of 1 532 692 lb. was returned for 1915-16 but the amount is probably much underestimated. — Myrabolans, very abundant, but no market has yet been found for them ; the Allahabad tannery found them to be a useful tanning material when combined with Bahul bark (*Acacia arabica*). — Turpentine ; pine forests are found mostly in the Shan States and Chin Hills ; they consist mostly of *Pinus Khasya*, which gives high quality turpentine, but it is not yet manufactured in Burma. — Rock dammar, a valuable varnish obtained from the "thingan" tree (*Hopsea odorata*). — Pwenyet, a dammar made by bees in a funnel-shaped opening at the mouth of their hives ; used chiefly for caulking boats, 18 000 lb. were produced in 1915-16. — Wood oil, an oleo-resin called gurjan oil in India and kanyin-si in Burma, obtained from the Kanyin tree (*Dipterocarpus turbinatus*) ; used for varnish, lithographic ink, as a substitute for balsam of Copaiha

AGRICULTURAL STOCK. — The 1916-17 census gave a return of 5 million cattle, of which nearly half are bulls or bullocks, and 1 ¼ million buffaloes. Butcher meat and milk are unobtainable except in the vicinity of towns. Sheep breeding is almost unknown, although the climate of parts of Upper Burma and especially of the Shan States would be most suitable for the purpose. The Burmese pony is a very superior animal ; the infusion of foreign blood has not been very successful. Mules are not bred, although thousands are required in Burma every year. In 1915-16, 106 787 cwt. of raw hides were exported in 1913-1914, the figure was 170 781 cwt.).

Fisheries provide a substantial part of the food consumed in Burma. In Bassein and Tavoy districts valuable turtle banks are leased for the collection of eggs. At Mergin on the Tenasserim coast there are pearl fisheries where Mr. SOLOMON attempted to produce pearls artificially with encouraging results ; he slips some irritating substance below the mantles of the oysters, and imprisons them in floating crates, where he feeds them for about 18 months. The irritation causes the animal to cover the cause of offence with nacreous secretions. Despite her wealth in fisheries, Burma does not provide enough fish for home consumption. In 1913-14, an average year, 264 000 cwt. of salted and unsalted fish were imported, chiefly from the Straits Settlements and India.

2 - The "Mission Antipaludique" to the Eastern Army and the Control of Paludism. — I. Work and Results of the Anti-paludic Mission to the Eastern Army, in the *Bulletin de la Société de Pathologie exotique*, Year XI, No. 6, pp. 456-469 + 1 Map. Paris, June 12, 1918 — II. BLANC, G. and HECKENROTH, F., Distribution of Paludism in the Koritza Region (Lower Albania), Map of Blood Counts *Ibid.*, pp. 470-483 — III. DELAMARE, G. and ROBIN, Map showing the Paludism of the Albano-Macedonian Confines, *Ibid.*, pp. 483-503 + 1 Map. — IV. MARTIN, L., Technical Article on Anti-larval Measures to be carried out on the Ground. *Ibid.*, pp. 503-517. — V. BROSSIERE, F., Paludism and Drainage, Work carried out in the Eksissu Region, Western Macedonia. *Ibid.*, pp. 517-530 + 12 Maps + Figs. and Photographs — VI. JOVEUX, C., Note on Macedonian Culicidae. *Ibid.*, pp. 530-547 + 32 Figs. — VII. Bibliographical Index *Ibid.*, p. 547.

M. J. GODARD, former Under Secretary of State for Public Health in France, sent, at the beginning of 1917, in agreement with the Commandant and Direction of the Health Service of the Eastern Army, a Mission for anti-malarial prophylaxis. The work done by the mission was extremely useful, as Macedonia is the greatest reservoir of malaria in Europe, and important results were obtained.

I. — In the paper entitled *Travaux et résultats de la Mission antipaludique à l'Armée d'Orient* a general introduction is followed by a study of Macedonia, the organisation of the Mission, its work, endemic indices (this index is found by fixing the blood counts by the method described by MM. SERGENT), anti-larval measures, the control of the adult mosquito and protection against the virus.

II. Study of the distribution of malaria in the Koritza region (Lower Albania). The authors have taken the blood counts for the different villages in their sector, a very malarial region, and have prepared a map showing the results. The variations found in the counts in river-side villages show up local conditions produced by watercourses.

III. — The authors have made a map showing the malaria present on the Albanian-Macedonian confines, a region which, save the Prespa valley, is little affected.

IV. — In his technical report on anti-larval work to be carried out, the author deals in order with cantonments (for troops in the fields), rivers (in their centre and on their banks), streams, useful stagnant water (wells, irrigations, watering-ponds), useless stagnant water, the construction of open drains, underdrainage, and summary levelling.

V. — Malaria and drainage. — account of the work done in the Eksissu region (western Macedonia).

VI. — The author, in a note on Macedonian Culicidae, studies the geographical distribution of the Macedonian species, describes the larvae and gives his researches on hibernation, the "anophelian index" (percentage of infected anopheles), and other parasites of anopheles (Flagellates and Trematodes).

VII. — Bibliography of 10 publications dealing with questions relating to malaria.

- 3 - **The Migration of Mosquitos.** — HEADLEE, T. J., in the *Scientific American Supplement*, Vol. LXXXV, No. 2205, pp. 214-215. New York, April 6, 1918.

The problem of the destruction of the mosquitos in a given locality is complicated by the fact that the insects migrate, often over long distances. Entomologists who have studied the question have found that certain species of *Anopheles* can travel as far as 60 miles (observations of MITCHELL in 1879 and 1886 and YOUNG in 1909, etc.). The species that fly farthest are usually those that lay their eggs on salt marshes.

The cause of mosquito migrations is obscure, but it can be assumed that they are due to the need of finding more abundant food when a species breeds very intensely upon a large area. LEPRINCE and ORENSTEIN have shown at Panama that swarms of *Anopheles albimanus* (an important carrier of malaria) regularly flew $\frac{1}{2}$ a mile from their ordinary habitat to a village in order to find food, returning before morning.

When swarms migrate over long distances they usually find breeding places near their food supply and rarely return to where they were bred.

Air movements, atmospheric moisture and temperature influence migrations.

The author considers that long-distance flights are due to the search for food. Air currents, as long as they are not too high to prohibit movement, do not affect the short ordinary flights, while winds of low velocity appear to favour long flights.

These facts show that in the practical work of control all the species infesting a given locality must be studied for a whole summer, so as to determine which are indigenous and which visitors. The sources of the invading pests should also be found and eliminated.

- 4 - **Hibernation of Mosquito Larvae, in Macedonia.** — IACAZE, H., in the *Bulletin de la Société de Pathologie exotique*, Vol. XI, No. 8, pp. 729-730. Paris, October 9, 1918.

The Antimalarial Mission of the Eastern Army has found — at any rate in Macedonia, where the work was carried out — that the mosquitos *Pyrethrophorus palestiniensis* (Theobald, 1903), *Culex pipiens* (Linné, 1758) and *Uranotaenia unguiculata* (Edwards, 1913) can hibernate in the larval state.

- 5 - **Food Chemistry in the Service of Human Nutrition.** — SHUMMANN, H. C., in the *Journal of Industrial and Engineering Chemistry*, Vol. X, No. 5, pp. 383-390 + Bibliography of 30 Publications. New York, May 1, 1918.

The author discusses in detail the question as to how adequacy of nutrition can be combined with such a use of food as to produce both financial and national economy.

An adequate diet should provide sufficient amounts of digestible organic nutrients to yield the necessary number of calories of energy. The average hourly expenditure of energy by an average man (70 kg.) under different conditions of activity is (calories):—

Sleeping, 60-70; awake, lying still, 70-85; sitting at rest, 100; standing at rest, 115; tailoring, 135; typewriting rapidly, 140; bookbinding, 170; light exercise (bicycle ergometer), 170; shoemaking, 180; walking slowly

(about $2\frac{3}{8}$ miles per hr.), 200; carpentry, 240; metal working, 240; industrial painting, 240; active exercise (bicycle ergometer), 290; walking actively (about $3\frac{3}{4}$ miles per hr.), 300; stoneworking, 400; severe exercise (bicycle ergometer), 450; sawing wood, 480; running (about $5\frac{1}{4}$ miles per hr.), 500; very severe exercise (bicycle ergometer), 600.

The daily food allowances for healthy boys should provide a quantity of energy equivalent to 900-1 200 calories for boys under 2 years, 1 200-1 500 for those from 4 to 5 years, 1 700-2 000 for those from 9 to 10 years, 2 600-3 100 for those from 14 to 15 years, 2 700-3 400 for those from 16 to 17 years. The requirements of *girls* are somewhat lower, especially after 8 or 9 years. The maintenance of an optimum degree of fatness (which, as SYMONDS has shown, is very near the average of healthy Americans) is usually the best evidence that the energy value of the diet is well adjusted to the needs of the individual. The estimation of the calories in the food is not necessary as a means of establishing the adequacy of the customary food intake if this is already established by the obvious condition of nutrition of the individual concerned; but if it is a question of rationing either an individual or a community then adequate energy value of the ration is the first thing that must be considered, for only when the energy supply is adequate can the tissue-building constituents of the body and of the food be conserved to the best advantage.

The author estimates the daily protein requirement of a man to be about 75 gm. The requirements of children for protein as well as other tissue-building material will be considered as proportional to their energy requirements and therefore much higher per unit of weight than in the case of adults. An adequate diet should provide a suitable quantity of ash constituents and furnish them in suitable proportions. A series of researches show that the average American dietary contains a much more liberal margin of protein than of either phosphorus or calcium, and that while the danger of a protein deficiency is rarely serious the danger of a deficiency of phosphorus or calcium is more important. Phosphorus deficiencies are plainly more frequent than are deficiencies of protein, and calcium deficiencies are more frequent still. The old assumption that adequate protein may be taken as meaning adequate supplies of all tissue-building material is found to be wholly misleading.

The iron requirement may average about 0.010 gm. and the corresponding standard be placed at 0.015 gm. per man per day. On this basis it would appear that the danger of a deficient intake of iron on freely chosen diet is less than in the case of calcium but much greater than is the danger of a deficiency of protein.

For growing children the standard allowances of these substances in grams per 100 calories may be reckoned as 2.5 gm. of protein (which should be mainly in the form of milk protein in the dietaries of growing children), 0.048 gm. of phosphorus, 0.023 gm. of calcium, and 0.0005 gm. of iron. In addition an adequate diet supplies the organism with sufficient quantities of those substances so far unidentified, i. e. food hormones or vitamins.

The vitamin requirement cannot be stated in term of actual weights of

Fat-Soluble A and of Water-Soluble B, but the percentages of certain foods rich in the one or the other of these essentials which suffice to make an otherwise satisfactory diet adequate for normal growth and reproduction have been determined experimentally by OSBORNE and MENDIL and by MCCOLLUM and his associates, so that the relative richness of several of the chief types of food in these dietary essentials is known in a general way, so that this factor of food value can be taken into account in considering the prominence which should be given to each type of food in planning an adequate and economical diet. It is very interesting to find how generally the types of food rich in calcium (milk, eggs, vegetables) are rich in vitamins as well, so that in safeguarding against deficiency of the element most likely to be deficient, an ample intake of vitamins is assured.

An adequate diet should include a sufficient amount of material of such physical character as to ensure the proper handling of the food mass and its residue in the digestive tract.

Dealing with the application of these principles to the choice of food, the author says that "it seems a good general rule for families of any level of income or standard of living to spend at least as much for milk as for meat, to spend at least as much for vegetables and fruit as for meats and fish".

As regards substitutes for wheat the author adds: "To the extent that the saving of white wheat flour means an increased use of the coarser flours and of oatmeal and potatoes in breadmaking (or potatoes in place of white bread) this also will result in an improvement in the mineral and vitamin content of the diet. To the extent that wheat flour is replaced by maize-meal, we may anticipate no appreciable gain or loss in nutritive value".

6 - **Action of X Rays on Barley Grains in Relation to Dietary Deficiency.** - WEILL, E. and MOURIQUAND, G., in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 21, pp 1107-1109 Paris, 1918.

The sterilisation of meat, cereal grains and pulse destroys the anti-beriberic property of these foods, probably owing to the destruction of one or more substances of the type of FUNK's vitamins (1). The authors have attempted to ascertain whether heavy exposures to X rays capable of disturbing the germinating power of the seeds could also deprive them of their anti-beriberic power. In the experiments whole, raw barley grains were divided into 3 groups, which were exposed to the rays for 3, 6 and 9 hours respectively. Fifty grains from each lot were spread on water-soaked cotton to germinate in diffused light at a temperature of 20°C. The grains exposed for 3 hours began to germinate after the third day, and, on the tenth day the length of the stems was about equal to that of the control grains. The grains exposed to the rays for 6 hours germinated less actively and those exposed for 9 hours either germinated late or not at all. These seeds as well as the control seeds were given as the sole food to pigeons of approximately equal weight at the rate of 20 gm. per day.

(1) See R, Jan and Feb 1918, Nos 2 and 125 (Ed)

The control grains maintained the pigeons normally, with or without increase in weight. The grains treated for 3 hours were given to 2 pigeons, to one for 257 days, to the other for 206 days; the weight of the first changed from 355 to 370 gm. and that of the second from 330 to 320 gm. A third pigeon received for 167 days grain treated for 9 hours; its weight increased from 300 to 340 gm. None of the pigeons showed any symptom of beriberi, or a disturbance of the general health.

Recently the authors have learnt that there is a form of beriberi that manifests itself very late (1). The presents results cannot, therefore, be taken to show that treatment with X rays has produced no partial dietary deficiency. But, as the pigeon is so very sensitive to dietary deficiencies in grain, it may be assumed that the eventual deficiency caused by the rays is not of great account and that, moreover, the nutritive value is not affected, given that the growth curve of the pigeons fed with treated grains was similar to that of the pigeons fed on the control seeds.

7 - **Progress in Agricultural Instruction in Latin America.** — *Experiment Station Record*, Vol XXXVIII, No 2, pp 199-200 Washington, 1918

AGRICULTURAL
EDUCATION

A recent executive decree in COLOMBIA provides for the establishment of a tropical agricultural station annexed to the national institute of agronomy in the municipality of San Lorenzo, department of Tolima. General instruction is expected to be given in various branches of agriculture and allied sciences, including veterinary science and courses will also be arranged for students who desire to specialize along certain lines. Particular attention will be paid to teaching students how to distinguish beneficial from injurious insects met with in practical agriculture. The government of the department of Antioquia has taken preliminary steps to establish a laboratory for the manufacture of vaccine to be used by stockmen in the prevention of murrain and similar diseases of cattle. A recent executive decree places the national meteorological service, established in 1917, under the department of public instruction.

The school of agricultural mechanics at Bahía Blanca, ARGENTINA, which admits pupils of not less than 7 years of age, had an attendance of 32 in 1916. The shops of the school have been equipped with new machinery.

A BRAZILIAN forestry service has been authorized, to be under the direction of the department of agriculture and to have for its object the conservation and improvement of forests and the regulation of all matters pertaining to them.

The department of agriculture of the DOMINICAN REPUBLIC has provided a travelling agricultural instructor to recommend measures for obtaining more abundant yields of staple crops.

An agricultural school was recently organised at Charpentier, HAITI.

An agricultural experiment station of the coeducational schools of Amatitlan, GUATEMALA, recently began operations, the equipment having been given privately.

In MEXICO a school of agriculture was opened in Hermosillo, the capital of the State of Sonora, in March, 1917, under the direction of the governor of that commonwealth. In the same month a national forestry school was inaugurated at Coyoacan, a suburb of the City of Mexico. The agricultural experiment stations in the States of Vera Cruz, Puebla, San Luis Potosí, Oaxaca, and Tabasco, have been supplied with modern machinery and appliances, as well as improved seeds, and instruction by experts will be given to farmers in these states. A publication entitled "Revista agrícola" has been founded in the national capital.

An agricultural school has been established in the Department of Leon, NICARAGUA. The government has also formulated a plan for a course of instruction in the new national school of agriculture, according to which there will be a section for the instruction of labourers or farm hands, a section for agriculturalists or farmers, and a section for agronomists or agricultural engineers. The governor of each province is to select by competitive contests two boys, who have passed the fourth grade of primary instruction and are over 13 years of age, for entrance into this school at the expense of the State. A school for boys not over 16 years of age, who have studied agronomy for at least a year, was opened recently at Chinandega City, with an appropriation of \$5 000 for its installation. It is equipped with up-to-date machinery and implements necessary for the proper cultivation of cereals and other crops, and makes a speciality of teaching its pupils the practical use and advantages of machinery in agricultural operations.

The agricultural bank in PARAGUAY has established weather bureaus in the principal farming centres and proposes to compile statistics based on data obtained from these stations.

The government of URUGUAY has granted 10 scholarships in its agricultural school to young Paraguayans who desire to continue their studies in Uruguay.

A law recently passed by the PERUVIAN Congress establishes an industrial school in the city of Iquitos. This school has an agricultural department and a department of arts and crafts, and is to be maintained from the proceeds of a tax on rubber shipped through the port of Iquitos and on the registered tonnage of vessels clearing from this port with cargoes for delivery to the port of Loreto. The course offered by each department is to extend over 3 years. The agricultural department is intended to fit students for trained work in the vast agricultural region of Peru, east of the Andes Mountains, much of which is as yet unexplored except in the immediate vicinity of navigable streams, and nearly all of which is virgin territory for the development of agriculture. The site of the agricultural department will be the Cañcho Experimental Station in Iquitos. An executive decree of April 10, 1917, also provided for the reorganization of the national school of agriculture and veterinary science and the enlargement of its functions.

A recent executive decree in SALVADOR provides rules and regulations for the operation of the plant pathology laboratory established under the governmental order of September 19, 1914, for the study of the diseases

of plants and proper methods and remedies for preventing and combating them.

An executive decree in URUGUAY places its agronomic stations under the immediate supervision and control of the Department of Fomento. At the suggestion of the park commission of Montevideo, a school for gardeners has been established in the national capital for the purpose of supplying special skilled labour of this kind. The Uruguay national nursery at Toledo is furnishing a large number of trees for planting operations. A recent decree prescribes that persons owning not less than 100 hectares of land shall be supplied gratis with 100 trees, and it is estimated that 100 000 trees will be distributed annually in this way. The nursery referred to will also donate to rural communities, schools, police farms, etc., 100 000 trees during the present year and 200 000 trees yearly thereafter. For the purpose of increasing the cultivation of flax, which has considerably decreased during the last few years, the president of the Republic has issued a decree requiring expert agronomists at the Estanzuela nursery, as well as those at the agricultural stations at Salto, Paysandú, and Cerro Largo, to investigate and report on the different kinds of flax grown in these regions

8 - Recent Investigations carried out at the Imperial Institute, London (1). -- *Bulletin of the Imperial Institute*, Vol. XVI, No. 1, pp. 1-35. London, January March, 1918.

EXPERIMENTAL
AND
ANALYTICAL
WORK

UTILISATION OF RICE AND ITS BY-PRODUCTS. The Imperial Institute has investigated the suitability of various kinds of Burmese rice for industrial and other purposes (apart from its direct use as food) as well as the possibility of utilising rice straw and rice husks for paper-making. Twelve samples of rice, produced in the course of selection experiments at the Agricultural Station, Hmawbi, Lower Burma, were divided into 4 groups: 1) *Hard long grain*: Enmata, Letywezin, Bankouk, Taung-deikpan, Bausamati; 2) *hard transparent grain*: Byatcale, Ngasein; 3) *soft transparent grain*: Beelugyun-Ngasein, Byatthidat, Bawynt; 4) *soft opaque grain*: Byatcale, Sabanet. The following numbers show, for each variety, the size (number of whole grains in 10 c. volume), percentage of broken grains, percentage of husk, and the percentages of proteins, fat, starch, fibre and ash in the seeds:— Enmata: 365-40-21.1-14.3-9.1-0.7-75.3-0.1-0.5; Letywezin: 477-6.8-23.1-14.2-8.9-0.9-75.2-0.2-0.6; Bankouk: 390-25.2-21.2-13.7-0.3-0.6-75.3-0.5-0.6; Taungdeikpan: 481-35.8-24.5-13.6-8.9-0.8-75.7-0.3-0.7; Bausamati: 592-53.1-23.2-13.7-10.0-0.8-74.6-0.1-0.8; Byatcale: 388-48.6-21.4-14.1-7.4-1.7-6.5-0.2-0.7; Ngasein: 413-9.6-21.1-14.1-6.9-0.9-77.3-0.2-0.6; Beelugyun-Ngasein: 295-50.6-19.6-12.6-8.0-0.7-77.9-0.2-0.6; Byatthidat: 346-16.2-20.7-12.9-8.0-0.6-77.5-0.2-0.8; Bawynt: 383-11.6-21.2-13.8-7.9-0.7-76.6-0.2-0.8; Byatcale: 314-32.5-20.8-13.5-7.4-0.7-77.5-0.2-0.7; Sabanet: 364-13.6-21.3-14.3-6.9-0.6-77.3-0.2-0.7.

The Enmata, Letywezin, Byatcale, Bankouk, Taung-deikpan and Ngasein varieties were judged of good quality both for consumption and for milling. The Beelugyun-Ngasein and Byatcale varieties were, however, judged

(1) See R. Dec. 1918, No. 1325 (Ed.)

differently by the different experts and seem most suitable for milling. All the 12 varieties were judged to be suitable for brewing and starch manufacture.

Rice straw from Egypt and containing 11.8 % of water, 17.6 % of ash, 50 % of cellulose (the last two figures expressed on the dry straw), length of ultimate fibres 0.6 to 3.0 mm., mostly 0.9 to 1.3 mm, gave on treating with caustic soda (boiling at 140°C. for 4 hours) at strengths of 4 to 1.5 %, yields of bleachable pulp varying from 44 to 53 %. By treating with milk of lime (20 parts of CaO per 100 of straw for 12 hours at 140°C.) a yield of 56 % of a pulp that could not be bleached satisfactorily was obtained. The pulp obtained by both methods was of good quality.

The sample of rice husks examined contained 7.9 % of moisture and the dry husks yielded 14.7 % of ash and 42 % of cellulose. The ultimate fibres varied in length from 0.5 to 1.5 mm., being mostly from 0.5 to 0.7 mm. By treating with a 4 % solution of caustic soda for 4 ½ hours at 140°C, a yield was obtained of 36 % of pulp containing a large proportion of gelatinous material which could not be satisfactorily removed by beating and washing. The pulp could not be bleached and gave a weak, brittle paper; it therefore could not be used for paper-making.

NEW OIL SEEDS FROM SIERRA LEONE - *Pentadesma butyracea* (Nat. Ord. Guttiferac) is a large tree confined to tropical West Africa where it is known as the "butter or tallow tree". It occurs in small patches in Sierra Leone, but is not common. It is said to be easily grown. The dry kernels give a yield of 41.8 of oil, the characteristics of which are shown in the appended table. The residual meal cannot be used for feeding purposes and is of every little value as manure owing to the small amount of nitrogen present.

Characteristics of some oils from Sierra Leone

	Oil from <i>Pentadesma</i> <i>butyracea</i>	Piassava oil	Po-voak oil
Specific weight at 15° C.	0.856	0.919	0.963
Melting point of fatty acids	33° C.	—	30.6° C.
Solidifying point of fatty acids	—	11.1	—
Acid value	17.4	6.2	2.6
Saponification value	191.7	192.7	189.1
Iodine value	42.8	79.5	156.9
HUMER value	—	94.7	—
Insoluble fatty acids	—	92.6	—
Unsapondifiable matter	—	2.1	0.84
Volatile acids, soluble	—	0.3	—
Volatile acids, insoluble	—	0.2	—

A sample of oil described as "piassava oil" and presumably obtained from the fruit of *Raphia* sp. (several species of this genus, especially *R. Sese* of the Congo, *R. Hookeri* and *R. textilis* of the coastal region of tropical West

Africa have fruit with a scaly envelope containing oil ; the natives use the oil for lighting and lubricating and to some extent as an edible oil) was examined. The oil received from Sierra Leone resembled palm oil (*Elaeis guineensis*) in colour, but was more liquid.

"Po-Yoak" oil is probably derived from a species of *Parinarium* (Nat. Ord. Rosaceae). Several species of this genus occur in West Africa, including *P. curatellaeifolium*, *P. excelsum* (grey or rough-skinned plum), *P. macrophyllum*, (ginger-bread plum), *P. Mobola* (mola or mobola plum), and *P. polyandrum* all with edible fruit. The high iodine value of Po-Yoak oil indicates that it belongs to the class of drying oil.

NATURAL DYE-STUFFS — As the war stopped the exportation of synthetic dyes from Germany, the result was that a number of natural dye-stuffs which had been nearly or entirely replaced by the artificial products again came into use on a large scale, especially indigo and fustic. The exports of indigo from India rose to 10 939 cwt. in 1913-14, to 41 932 cwt. in 1915-16 and to 33 539 cwt. in 1916-17; these figures were far behind those of some 20 years ago, the exports in 1896-7 being nearly 170 000 cwt.

Fustic, which consists of the wood of *Chlorophora tinctoria* is obtained chiefly from Jamaica, Honduras and Brazil, and in smaller quantities from British Honduras. In 1913, Jamaica exported 3 450 tons, in 1915, 8 160 tons, chiefly to the United States and France. The scarcity of dye-stuffs also led to a search for new sources of supply of the better-known materials, and many samples of such products were sent to the Imperial Institute for examination.

The name Braziletto is applied to several dye-woods of the West Indies and Central and South America ; the Braziletto of the Bahamas is *Caesalpinia bahamensis* ; that of Brazil is *C. echinata* ; that of the Antilles is *C. brasiliensis* ; that of Peru and Columbia is *C. bicolor* ; that of Colombia, Venezuela, Mexico, Guatemala, Nicaragua and Lower California is *Haematoxylon Braziletto*. The name Brazil wood was originally applied to the dye-wood of the East Indian tree, *Caesalpinia Sappan* now known in commerce as sappan wood, and was transferred to that of the South American trees on the discovery of the New World, the country of Brazil being so called on account of the abundance of red dye-woods there. Brazil wood was at one time largely used as a dye-stuff in Great Britain, but it was replaced to a great extent by the West African camwood (*Baphia nitida*), which is still occasionally imported. The colouring matter of Brazil wood, peach wood and sappan wood is freely soluble in water, and it was formerly used alone for calico-printing and, in conjunction with other dye-woods for dyeing wool. The colours produced by these woods are rather fugitive. Camwood, with the allied dye-woods, barwood (*Pterocarpus Soyauvi*), of West Africa, and red sanders or red sandal wood (*Pterocarpus santalinus*) of India, is used principally for dyeing wool, giving fairly fast colours. Logwood is one of the few natural dye-stuffs that has held its own in competition with synthetic dyes; it is obtained from *Haematoxylon campechiannum*, a native to Mexico and British Honduras, and introduced to most of the West India islands and other parts of the tropics. The chief com-

mercial sources are the Campeachy and Yucatan district of Mexico, Jamaica, British Honduras, Haiti and St. Domingo. Mauritius has of late supplied considerable quantities of log-wood.

The manufacture of synthetic indigo has been started in the United Kingdom, the United States, France, Switzerland, etc., so that, after the war synthetic indigo will compete vigorously with the natural product. Indigo is, however, an annual crop and being cheap to grow, may probably hold its own. The Imperial Institute has received for examination, samples of indigo (which was of rather low grade) from Nyassaland and Nigeria, as well as an indigo plant from Natal (*Indigofera arrecta*). This leaves of this latter plant contained 9.4 % of moisture and 0.42 % of indigotin; it was judged to be quite satisfactory as a source of indigo.

A sample of the roots of Indian madder (*Rubia cordifolia*), from South Africa, contained 12.5 % of moisture and 41 % of a matter extracted by boiling water and which forms a very good dye.

A small sample of the lichen *Neurospogon melananthum* (- *Usnea melananthum*) was sent from the Falkland Islands. This lichen is considered by some authorities as a variety of *Usnea barbata*. It was found that the lichen could be used for the direct dyeing of wool by boiling with it for 2 or 3 hours.

COFFEE AND TEA FROM UGANDA. — Coffee is the most important crop grown on European plantations in Uganda; its value as an export is only exceeded by that of cotton. In 1915-16 there were 12 162 acres under *Coffea arabica* and 264 acres under *C. robusta*. In addition coffee was interplanted with Para rubber on an area of 4 747 acres. To this should be added the plantations belonging to the various missions and the 10 420 acres of coffee cultivated by natives in 1916-17. Most of the coffee is grown in the Buganda province, but rapid progress has been made recently in the Northern Province. In 1916-17 the export was 48 600 cwt. worth £113 939. Samples of Robusta coffee from the Government Plantations, at Kampala and Kakumiro, had from 11 to 14 % of parchment and 86 to 89 % of beans; from 156 to 282 beans were required to fill a 50 cc. measure. These samples were judged to be of very promising quality.

Though Europeans have begun to cultivate tea in Uganda, it is not yet grown on a commercial scale. The experimental plots at the Government Plantations, at Kampala and Kakumiro, have given encouraging results, and in 1915-16 the Kampala plot, planted in 1911, yielded 135 lb. of prepared tea per acre. A sample of Uganda tea examined at the Imperial Institute was found to contain 11.2 % of water and the following percentages expressed on the dry tea: — Caffeine, 4.7; tannin, 12.8; ash, 6.2; extract (after infusion for 10 minutes), 32.2. It is thus rich in caffeine as Indian teas usually contain only 3.5 to 4.0 % and China teas somewhat less.

AROMATIC OILS FROM SEYCHELLES. — Besides *Ocimum viride*, the oil of which is used for the extraction of thymol (1), several other species of that genus have been introduced into Seychelles and now occur in a wild or semi-

(1) See R., Oct. 1918, No. 1075. (Ed.)

wild state, e. g., *O. gratissimum*, known as "Basilic grandes feuilles" and *O. Basilicum*, known as "Basilic de France".

By distilling the whole shoots the former yielded 0.1 % of oil, and the latter 0.21 %. Investigations made at the Imperial Institute showed that *O. gratissimum* oil from Seychelles contains 62 % of phenols which were principally eugenol, while that of the same species from the Ivory Coast contains 44 % of phenols which are almost entirely phenol. The oil of *Basilicum* from Seychelles appears to contain anethole as well as methylchavicol and thus differs from commercial sweet basil oil. It does not seem likely that any considerable market could be found for basil oil from Seychelles.

AJOWAN (*Carum coplicum*) SEED AND THYMOL. — The plant is grown on a commercial scale chiefly in India, and before the war the seeds were exported mainly to Germany, where the oil distilled from them was used as the principal source of the antiseptic thymol. Since the war the plant has been grown experimentally in other parts of the British Empire, including Seychelles and several of the West Indian Islands. Samples of the seed grown in Seychelles and Montserrat were sent to the Imperial Institute for examination. Those from the Seychelles (in large part immature) yielded 3.4 % of thymol and about 9 % of oil. The others yielded 3.1 % of oil of sp. gravity at 15°C. 0.925; the optical rotation in a 100 mm. tube was + 0.90° and the thymol content was 5.4 %. At Montserrat the best results were obtained by sowing on November 1 and harvesting 6 months after; a yield of 1 128 lb. per acre was obtained. Ajowar seed could be grown successfully in the above-mentioned islands as a source of thymol.

CROPS AND CULTIVATION.

9 — **Climatic Control of the Morphology and Physiology of Beets.** — SHAW, H. B., in *Sugar*, Vol. XIX, Nos. 10-12; Vol. XX, Nos. 1-4 + 10 Figs. Chicago, 1918.

AGRICULTURAL
METEOROLOGY

VEGETABLE GROWTH AND REPRODUCTIVE GROWTH. — Abundant food and moisture together with a high temperature favour vegetable growth, whereas the contrary conditions stimulate the formation of the reproductive organs. From a practical point of view it is, therefore, essential to know what external agents influence the morphological state of the plants grown so as to favour the best adaptation to the end in view, seed production or abundant vegetable growth.

The most important factors having a marked effect on the growth are meteorological factors, especially temperature, the effect of which is dominant and which, in conjunction with other more or less closely correlated phenomena (moisture, evaporation, etc.) makes up what the author calls the "thermal whole". In the investigations described by the author an analysis of the environment in many sugar beet-growing districts of the United States as well as in the wild beet district has made it possible to determine very exactly the effects of climate on this plant, especially with respect to seed-production. The mother beets were planted successively between spring, and the season when the gradually increasing temperature had

reached its maximum. When the moisture and food conditions are equal the effect of an increase in temperature is to stimulate physiological activity and, consequently, vegetable growth. The later the mother beets are planted, the smaller is the percentage of fertile plants, until finally only plants without floral branches remain.

EFFECT OF TEMPERATURE ON THE CROWN — In the spring the aerial part may develop in a vegetative sense or a reproductive sense according to the weather during the first growing phases. The floral branches may develop late even when the plants have already formed their first leaf whorls. In a general way it may even be said that the bud cells are capable of reproductive development at any moment of the growing period so long as growth is slow.

THE NECESSITY OF A PROTRACTED PERIOD OF GROWTH. — A more or less protracted period of restrained growth is necessary for the formation of the reproductive organs. This is shown by the two following experiments : —

1st Experiment. — The mother beets were stored during the winter at a sufficiently low temperature to prevent all growth. At the time of planting they were dry and shrunken so that growth began late, when the average temperature was above 10°C, rising rapidly during May. Consequently, as a result of the warm temperature, growth was very rapid, resulting in the production of a large quantity of leaves and branches and few seeds.

2nd Experiment. — The mother beets were stored during winter at a temperature sufficiently high to permit of restrained growth. At the time of planting they were plump, and the buds big and ready to burst. Immediately after the plants began to grow while the average temperature was still low. The temperature during May was lower than that of the first experiment. The result was restrained growth of the vegetative organs and good seed-production.

To assure good reproductive growth of the beet the mother beets must be stored during winter at a temperature sufficiently low to prevent all growth and the temperature during the first weeks after planting must be low.

A REST PERIOD NOT NECESSARY TO DETERMINE REPRODUCTIVE DEVELOPMENT. — In certain districts, such as those of North America, a rest period may even prove harmful for the reasons already given. In the Salt River Valley, Arizona (where frosts are practically unknown, the winter never cold enough to stop all growth and the conditions in early spring favourable to moderate growth) sowing in November gives a high percentage of annual beets and a good seed yield. Similar phenomena occur in the wild beet habitat in the Mediterranean coastal district where the mild winter and cool spring assure reproductive growth.

INFLUENCE OF SILO. — To protect beets in North America from the injurious effects of the cold winters they must be kept in silos, care being taken that the temperature is similar to that of the natural habitat of the plant so as to prevent complete stoppage of growth. The average temperature of the natural habitat (Adriatic district) from mid-November to the

end of March varies from 4.5° to 10°C . In the silos the temperature is above 4.5° till December 20, but then decreases rapidly till it is sometimes even lower than the surrounding air. The result is that the period of slow growth which ends towards December 20 does not suffice to assure reproductive development during the following spring. It is, therefore, necessary to plant early so that the first stages of growth may take place in an environment which is not yet too warm.

TEMPERATURE LIMIT FOR REPRODUCTIVE DEVELOPMENT. — Experiments made in Salt Lake Valley in which beets were planted at different seasons showed the maximum temperature limit for reproductive development to lie between 10 and 11°C .

EXCESS OF REPRODUCTIVE DEVELOPMENT. — When low temperature, scarcity of food, and other phenomena capable of lowering physiological activity act too long on the plant, an excess of reproductive growth accompanied by complete absence of foliage results, so that the plant runs entirely to seed. As the assimilation is insufficient to assure the development and ripening of the seeds the yield is much lower. Disease, drought, soil sterility, etc. may have effects similar to those of low temperature.

CAUSE OF THE VARIOUS MORPHOLOGICAL PHASES OF THE BEET. — The phenomena described above make it possible to explain satisfactorily the following phases:

1) *The wild beet as an annual.* Seedlings from seeds germinating in autumn are exposed to prolonged restrained growth when a mild winter is followed by a cool spring. Growth is then increased by the rise in temperature and by showers, which favour the development of the reproductive organs which have already started to grow during the winter and beginning of spring.

2) *The wild beet as a biennial.* — When, for some reason or other, the seeds do not begin to germinate in autumn but only with the first warm and rainy days of spring, the period of restrained growth is absent and the plant develops only leaves and sterile branches. The following winter these plants may, like annuals, be subjected to conditions determining slow growth which enables them to produce fertile branches and ripe seed.

3) *The wild beet as a seed-bearing perennial.* — When wild beets can survive a certain number of years (4 to 7) they are exposed each winter to conditions causing restrained growth with a resultant good seed yield in summer.

4) *The cultivated beet as an annual.* — When, after sowing in April, the weather remains cold for more than a month so as to allow restrained growth of the shoots, many plants behave as annuals. Summer drought, by retarding growth, also causes a high percentage of annuals.

5) *The cultivated beet as a biennial.* a) 1ST PHASE: — Late sowing in rich soil; as there is no period of restrained growth the development of the plant is purely vegetative.

b) 2ND PHASE. — The beets are stored in the silo during winter and if the conditions given above are observed, they will produce much seed the following summer.

6) *The cultivated beet as an unfruitful biennial.* — In many districts of the United States the passage from winter to summer is too sudden, making the second-year plants bad seed-producers.

7) *The cultivated beet as a seed-bearing or unfruitful perennial.* — Perennial seed-bearing beets may be obtained by keeping the mother-beets in the silo from winter to winter, and unfruitful perennials by growing them in a hot house.

• COMMERCIAL PRODUCTION OF SUGAR BEET SEEDS. — Sterility of mother beets causes considerable loss annually in the greater part of the United States and the south-west of Russia. In these districts the temperature rises suddenly at the beginning of spring, thus preventing any period of restrained growth. To avoid such loss the temperature in the silos must be controlled and the mother beets planted as early as possible in spring, even at the risk of incurring damage from frost. On the other hand, the temperature of Utah, U. S. A. and Prag-Vienna, Austria, is similar to that of the habitat of the wild beet. The relatively mild winter does not completely arrest growth and allows the beets to be planted very early in spring. Loss from sterility is, thus, very rare in these districts.

BIOCHEMICAL CAUSES OF REPRODUCTIVE AND VEGETATIVE GROWTH. — These are not yet definitely known. When conditions favour reproductive growth the cells of the growing points contain much glucose and no starch. When there is a tendency towards vegetative growth these conditions are reversed.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

10 - *Investigations into Soil Acidity, in the United States.* — I. ALLISON, F. E. and COOK, R. C., *The Effect of Ammonium Sulphate on Soil Acidity*, in *Soil Science*, Vol. III, No. 6, pp. 507-512 + 1 Fig. Baltimore, June, 1917 — II. NOYES, H. A. and YODER, L. (Purdue University, Agricultural Experiment Station, Lafayette, Indiana), *Carbonic Acid Gas in Relation to Soil Acidity Changes*, *Ibid.* Vol. V, No. 2, pp. 151-159 + 3 Figs. + Bibliography of 6 Publications, February, 1918. — III. TRUOG, E. (Dept. of Soils, Agricultural Experiment Station, University of Wisconsin), *Soil Acidity: 1) Its Relation to the Growth of Plants*, *Ibid.*, Vol. V, No. 3, pp. 109-195 + Bibliography of 49 Publications, March, 1918 — IV. WHITE, J. W. (Associate Professor of Experimental Agronomy, Pennsylvania State College, Agricultural Experiment Station), *Soil Acidity as Influenced by Green Manures*, in the *Journal of Agricultural Research*, Vol. XIII, No. 3 pp. 171-197. Washington, April 15, 1918

I. — EFFECT OF AMMONIUM SULPHATE ON SOIL ACIDITY. — It is well known that this manure increases the acidity of the soil to such an extent that, in extreme cases, it prevents crop growth. The author undertook to determine: — 1) this increase in acidity; 2) the effect of removing part of the added nitrogen by means of crops. The soils used were: — 1 nearly pure quartz sand, 1 sand, 1 sandy loam, 2 loams, and 1 clay. All were acid except the third. The experiments were carried out in greenhouses in series of 4 pots, each holding 2.5 lb. of soil + 1 gm. of superphosphate + 1 gm. of potassium sulphate. Half of the pots also received 0.5 gm. of ammonium sulphate. One of each of the treated and untreated pots was planted to buckwheat. At the end of every three months a further 0.5 gm. of ammonium sulphate was added till 2 gm. in all had been given. Throughout the whole experiment four crops were grown.

Results. — At the end of a year there was little difference in the increase of acidity in the different soils without ammonium sulphate whether cropped or fallow. The smallest increase occurred in the quartz sand and the greatest in the loam, but there was no relation between this increase and the texture of the soil.

In the soils with ammonium sulphate the increase in acidity was much greater than in the former (control) pots. The partial removal of nitrogen in the crops decreased appreciably the acidity of the quartz sand and clay soils, increased it in the loam soils, and left it practically the same in the other three. The average increase in acidity in the soils used (excluding the quartz sand) was 4.140 lb. of calcium oxide per 3 000 000 lb. of uncultivated soil, and 4.240 lb. in soil which had yielded four crops of buckwheat.

The increase in acidity produced by 100 lb. of ammonium sulphate corresponded, on an average, to 80 lb. of calcium oxide.

II. — CARBONIC ACID IN RELATION TO SOIL ACIDITY CHANGES. — These investigations aimed at determining the effect of applying CO_2 to soil on the acidity of the soil itself and of the plants. Paraffined Wagner pots, each containing an equal weight of soil mixed with manure and lime were kept at a uniform degree of moisture and small pepper plants (*Capsicum annum* var. *abbreviatum*) transplanted into them. There were five series of nine pots each, three without any CO_2 , three into which CO_2 was bubbled through the soil during 8 hours daily, and three receiving a constant stream of CO_2 . There were also two control pots.

Results. — Under greenhouse conditions, keeping the water-holding capacity of the soil one half satisfied increased its acidity.

Under the same conditions except that the soil was cultivated, acidity also increased, but this increase varied with the amount of lime and other fertilisers added.

The application of CO_2 to cultivated soil which had been either only limed or both limed and fertilised, increased its acidity.

Conclusions. — These results tend to confirm the chemical theories of the nature and causes of soil acidity.

The difference in the reaction of the soil tested to a neutral salt of a strong acid or a strong base (potassium nitrate) after the various treatments, seems to show the acidity of the soil to depend on hydrolytic mass action phenomena.

III. — SOIL ACIDITY IN ITS RELATION TO PLANT GROWTH. — The question is first discussed generally and 49 publications on soil acidity reviewed. From the data obtained from various sources the author has compiled the appended table showing the relation between the lime requirement of various plants and their response to the liming of acid soils, or, their capacity to grow in acid soil.

Conclusions. — The amount of lime to be applied in practical agriculture depends on: — 1) the lime requirement of the crop grown; 2) the acidity of the soil; 3) the fertility of the soil. The lime requirement of a plant is subjected to the following factors: — 1) lime content of the plant, 2) rate

Data on the lime content and requirement and feeding power for lime of cultivated plants, their response to liming or, reciprocal capacity to grow on acid soil.

Plant	State or portion of plant	Lime in plants analysed							Response to liming or reciprocal capacity to grow on acid soil
		Number of analyses	Percentage of dry matter	Relative quantity	Relative rate of growth	Relative amount of lime required for growth	Relative feeding power of plant for lime	Relative lime requirement of plant	
LEGUMINOSAE									
Alfalfa (<i>Medicago sativa</i>)	in flower	12	3.00	4 1/2	4 1/2	4 1/2	2	5	4
Sweet clover (<i>Melilotus alba</i>)	hay	1	1.94	3	5	4	3 1/2	3 1/2	4
Red clover (<i>Trifolium pratense</i>)	in flower	113	2.40	3 1/2	4	4	3 1/2	3 1/2	3 1/2
Mammoth clover (<i>T. medium</i>)	"	3	2.09	3	4	3 1/2	3 1/2	3	3
Alsike clover (<i>T. hybridum</i>)	"	3	1.62	2 1/2	3 1/2	3	3 1/2	2 1/2	2 1/2
Crimson clover (<i>I. incarnatum</i>)	"	4	1.92	3	3 1/2	3 1/2	4	2 1/2	2
White clover (<i>T. repens</i>)	"	4	2.21	3	3	3	4	2	2
Japanese clover (<i>L. pedunculata</i>)	"	1	1.28	2	3	2 1/2	3	2 1/2	2
Bean (<i>Phaseolus vulgaris</i>)	vines	4	1.32	2	1 1/2	3	4	2	2
Cowpea (<i>I.igna unguiculata</i>)	hay	1	2.70	4	4	4	5	2	2
Lupin blue (<i>Lupinus hirsutus</i>)	hay	3	1.05	1 1/2	4	3	5	1	1 1/2
Pea, garden (<i>Pisum sativum</i>)	vines	1	3	4 1/2	3 1/2	4	2 1/2	4 1/2	4
Peanut (<i>Arachis hypogaea</i>)	vines	1	2.08	3	3	3	3	3	3
Soybean (<i>Glycine hispida</i>)	hay	2	2.76	4	4	4	4	3	3 1/2
Serradella (<i>Ornithopus sativus</i>)	in flower	3	2.19	3	3	2 1/2	3	2 1/2	2
Vetch, common (<i>Vicia sativa</i>)	green plant	25	1.11	3	3	3	4	2	2 1/2
CEREALAE									
Barley (<i>Hordeum sativum</i>)	before flowering	3	0.95	1 1/2	4	3	3	3	3 1/2
Buckwheat (<i>Fagopyrum esculentum</i>)	in flower	7	3.33	4 1/2	4	4 1/2	5	3 1/2	3 1/2
Maize (<i>Zea Mays</i>)	"	7	0.83	1 1/2	5	3 1/2	3 1/2	3	3 1/2
Oats (<i>Avena sativa</i>)	before flowering	1	0.83	1	4	1	4	1 1/2	1 1/2
Rice (<i>Oryza sativa</i>)	whole plant	1	0.23	1	1	1	1	1	1
Rye (<i>Secale cereale</i>)	before flowering	1	0.5	1	4	1 1/2	4	1 1/2	1
Wheat (<i>Triticum vulgare</i>)	before flowering	2	0.48	1	3	1	1	1 1/2	2
HAY AND PASTURE GRASSES									
Italian ryegrass (<i>Lolium italicum</i>)	live stage	2	1.07	1 1/2	3	1 1/2	4	1 1/2	2
Johnson grass (<i>Sorghum halepense</i>)	"	1	0.2	1	4	1	4	1	1
Kentucky blue grass (<i>Poa pratensis</i>)	"	4	0.42	1	3	1	1	1 1/2	1 1/2
Meadow fescue (<i>Festuca pratensis</i>)	"	4	0.57	1	3	1	3 1/2	1 1/2	2
Millet	"	1	0.4	1	3 1/2	2	3 1/2	1	1
Orchard grass (<i>Dactylis glomerata</i>)	"	4	0.46	1	3 1/2	1	3 1/2	1 1/2	1 1/2
Perennial rye grass (<i>Lolium perenne</i>)	"	4	0.1	1	3	1	1	1	1
Redtop (<i>Agrostis vulgaris</i>)	"	4	0.7	1	3	1	1	1	1
Timothy (<i>Phleum pratense</i>)	"	1	0.71	1	3 1/2	1	3 1/2	1	1 1/2
FIBRE CROPS									
Cotton (<i>Gossypium hirsutum</i>)	whole plant	1	0.75	1 1/2	1	1	3 1/2	1	1 1/2
Flax (<i>Linum usitatissimum</i>)	"	1	0.5	1 1/2	1	1	1 1/2	1 1/2	1
Hemp (<i>Cannabis sativa</i>)	"	1	0.71	1 1/2	1	3 1/2	3 1/2	3	3
SUGAR YIELDING CROPS									
Sugar beet (<i>Beta vulgaris</i>)	leaves	25	3.0	4	2 1/2	3 1/2	2	4 1/2	5
Sweet sorghum (<i>Sorghum vulgare</i> var. <i>saccharatum</i>)	root	140	0.2	1	1	1	1	1	1
Sugar cane (<i>Saccharum officinarum</i>)	whole plant	1	0.1	1	4	1 1/2	4	1 1/2	2
	whole plant	13	0.19	1	4	1 1/2	3 1/2	2	2

Data on the lime content and requirement and feeding power for lime of cultivated plants, their response to liming or, reciprocal capacity to grow on acid soil (contd)

Lime in plants analysed									
Plant	State or portion of plant	Number of analyses	Percentage of dry matter	Relative quantity	Relative rate of growth	Relative amount of lime required for growth	Relative feeding power of plant for lime	Relative lime requirement of plant	Response to liming or reciprocal capacity to thrive on acid soil
VEGETABLES									
Potato common (<i>Solanum tuberosum</i>)	vines	6	2.86	4	2	3	3	3	2 ½
Potato, sweet (<i>Ipomoea Batatas</i>)	tubers	59	0.10						
Turnip (<i>Brassica Rapa</i>)	vines	1	1.70	2 ½	1 ½	2 ½	3	½	2
Cabbage (<i>Brassica oleracea capitata</i>)	leaves	10	3.83	5	1 ½	3 ½	2 ½	4	3
Cabbage (<i>Brassica oleracea capitata</i>)	root	37	0.85						
Carrot (<i>Daucus Carota</i>)	leaves	2	5.93	5	1 ½	4	2 ½	4 ½	4
Carrot (<i>Daucus Carota</i>)	root	3	1.17						
Cauliflower (<i>Brassica oleracea var botrytis</i>)	leaves	8	4.45	5	2 ½	3 ½	2	4 ½	3 ½
Cauliflower (<i>Brassica oleracea var botrytis</i>)	root	11	0.6						
Cauliflower (<i>Brassica oleracea var botrytis</i>)	leaves and stalk	1	0.04	3	2 ½	1	1 ½	4	
Cauliflower (<i>Brassica oleracea var botrytis</i>)	leaves	1	0.40	1	1	1	3	1	1
Cauliflower (<i>Brassica oleracea var botrytis</i>)	fruit	1	0.03						
Cauliflower (<i>Brassica oleracea var botrytis</i>)	young shoots	1	1.88	1 ½	3	3	1	5	5
Kohlrabi (<i>Brassica oleracea var caulorapa</i>)	leaves	1	4.4	5	2	3 ½	1	4	4
Kohlrabi (<i>Brassica oleracea var caulorapa</i>)	bulb	3	1.5	4	3 ½	4	1	4 ½	5
Onion (<i>Allium Cepa</i>)	leaves	1	3.03	5	1	3	1 ½	4 ½	5
Onion (<i>Allium Cepa</i>)	bulb	2	1.1						
Rhubarb (<i>Rheum rhabarbarum</i>)	leaves	1	0.32	1	4	1 ½	3	2 ½	1
Rhubarb (<i>Rheum rhabarbarum</i>)	stalk	1	1.45						
Radish (<i>Raphanus sativus</i>)	leaves	1	4.30	5	3	4	3	4	3
Radish (<i>Raphanus sativus</i>)	root	1	1.38						
Spinach (<i>Spinacia oleracea</i>)	tip	1	1.76	3	3	3		4	
Spinach (<i>Spinacia oleracea</i>)	vines	1	1		1 ½		3 ½	1 ½	
Strawberry (<i>Fragaria chiloensis</i>)	fruit	1	0.07						
MISCELLANEOUS PLANTS									
Hops (<i>Humulus Lupulus</i>)	whole plant	3	2.30	3 ½	3	3 ½	3	1	3 ½
Rape (<i>Brassica Napus</i>)	in flower	6	1.75	2 ½	3 ½	3	3	3	1 ½
Tobacco (<i>Nicotiana Tabacum</i>)	whole plant	1	3.40	5	3	4		5	4
Grape (<i>Vitis</i> sp)	leaves	18	2.55	3 ½	3 ½	3 ½	3	3 ½	3
WEEDS									
Sheep sorrel (<i>Rumex acetosella</i>)	leaves	1	1.13	4 ½	2	1 ½	1 ½	1 ½	1
TREES									
Chestnut	leaves	1	1.5	3 ½	½	3	3		3 ½
Mulberry		1	5.14	5	2	3 ½	2	4 ½	4 ½
Oak		1	0.01	1 ½	2 ½	1	3 ½	1 ½	
Pine	needles	8	0.52	1	1	1 ½	3 ½	1	1

Relative values of the 6 last columns to the right

1 = very low 2 = low 3 = medium, 4 = high 5 = very high

of growth of the plant, 3) feeding power of the plant for lime, dependent on a) extent and character of root system, b) internal acidity of roots, c) excretion of carbonic acid by the roots.

By comparing the figures given in the table, especially those expressing the lime requirement of the different plants, with those representing their capacity to grow in acid soils, a confirmation will be found of the theory that the chief disadvantage of the acidity of the soil is that it prevents the plants (especially those requiring much lime, but absorbing it with a certain amount of difficulty) from drawing this base from the soil quickly enough to satisfy their requirements. These considerations are important in devising a practical and rational liming system.

IV. SOIL ACIDITY AS INFLUENCED BY GREEN MANURES. - The investigations deal with the effect on the acidity of the soil of applications of organic matter (green and poultry and barnyard manures) to an acid soil from plots fertilised with ammonium sulphate for several consecutive years. With lots of soil of 500 gm. each were mixed either finely cut plants for green manure (soybean, Canada field pea, sweet clover, alfalfa, red clover hairy vetch, wheat, rape, oats, maize, rye, timothy, redtop, sorrel), or barnyard or poultry manure, in quantities corresponding to 10 gm. of dry matter. These mixtures were put in large jars and kept in the open for two months and then in a room, the optimum moisture content being maintained throughout the nine months of the experiment.

Results - During the first two weeks the lime requirement of these mixtures decreased by about one half, whereas that of the control lots did not change. An increase in the lime requirement was then observed which subsequently greatly exceeded that of the soil at the beginning. At the same time the nitric nitrogen content increased continually till it was double that of the control lots. This increase in nitrogen alone is not sufficient to account for the increase in the lime requirement.

Similar experiments made with the same green manures previously tried, gave the same results, except that the changes were lower.

Analyses showed that, at the end of the experiment, the soils with green manure contained more organic matter than soils without this fertiliser, although quite three-fifths of the vegetable matter added had disappeared during the experiment, the remainder having formed humus soluble in dilute alkalis. The plants added in a dry condition were as decomposed as those added when green. The lots with stable or poultry manure always contained more nitric nitrogen than the controls.

Conclusions - In an acid soil, such as that of the experiment fresh green manure decreases the acidity when first dug in, but increases it later. Nitrification occurs under favourable temperature, moisture, and aeration conditions and the nitric nitrogen content of the soil increases, in spite of its acidity. The increase in acidity is not due or largely so, to nitrification, but seems to depend on the organic matter added or its fermented residue, though the experiments gave no exact indications on this subject.

- 11 - On the Actual Number of Bacteria in the Soil.** - BRIGHT, J. and CONN, H. J. (Scientific Proceedings of the Society of American Bacteriologists) in *Abstracts of Bacteriology*, Vol. II, No. 1, Baltimore, 1918

For years soil bacteriologists have been trying to find some satisfactory method for determining the actual number of bacteria in the soil. On account of the obvious weaknesses of the plate method a more accurate method is desired. The chief difficulties of the plate method are ; - first, that many types of soil organisms will not grow on the ordinary nutrient media, and second, that groups of many individuals are often recorded as single organisms. A microscopic method of counting has recently been devised which eliminates these sources of error but introduces other possible sources, e. g., dead organisms may be counted if they take the stain ; small organisms may be overlooked owing to the presence of masses of organic matter which may shield them from view, and particles of organic matter in the soil may take the stain and thus be counted as organisms.

A series of experiments has been carried out which indicates that :

- 1) The plate count of normal soil is generally much lower than the corresponding microscopic count ;
- 2) the plate count of sterilised soil re inoculated with pure cultures of known soil organisms is much higher than the microscopic count in the cases of two of these organisms which are very small, and lower than the microscopic count in the case of another, larger organism ;
- 3) the normal flora is almost entirely disintegrated by the heat of sterilisation ;
- 4) there is a partial correlation between the plate and microscopic counts.

In short, wherever the organism has been known to grow on the plates the plate count has been as high or even higher than the microscopic count. The reason why the microscopic count in normal soil is so much higher than the plate count is because many of the organisms in soil do not grow upon the common nutrient media. As regards the actual number of bacteria in soil, it seems reasonable to assume that there may be 5, 10, or even 20 times as many organisms in normal soil as is shown by the plate method.

- 12 - Isolation and Study of Nitrifying Organisms.** GIBBS, W. M. and FRED, E. B. (Scientific Proceedings of the Society of American Bacteriologists) in *Abstracts of Bacteriology*, Vol. II, No. 1, p. 1, Baltimore, 1908

The purpose of this study was the isolation of the nitrifying organisms from three widely different types of soil - a light coloured upland silt, neutral in reaction, a light coloured silt, acid in reaction, and a black garden soil having a large amount of organic matter, neutral in reaction. Liquid culture media containing ammonia nitrogen for the use of the nitrite formers and similar media containing nitrite nitrogen for the use of the nitrate formers, were inoculated separately with these soils. Of the different sources of ammonia and nitrite nitrogen, ammonium sulphate and sodium nitrite gave the most rapid oxidation.

During the two and a half years that this investigation has been under way, the ammonia oxidising organisms of the neutral field soil have been carried through 46 enrichment cultures - those of the acid soil, 51 enrichments, and those of the garden soil 38. Enrichments of the nitrite oxidising organ-

isms of the different soils were obtained in a similar way. In the case of the *Nitrosomonas*, the average time required for oxidation of the ammonium sulphate was seven days, and for oxidation of the sodium nitrite about six days. All attempts to secure pure cultures of the nitrifying organisms by means of enrichment cultures and high dilutions failed. The total number of nitrifying bacteria increased with the number of enrichment cultures, while at the same time this process was accompanied by a gain in the number of contaminating forms, a small coccus and a rod which occurred in great numbers, both in enrichment cultures and on plates of washed agar or silicic acid jelly.

For isolation washed agar and silicic acid jelly gave the best results. Colonies formed on these media were too small to be picked off by ordinary means and a modification of the Barber method was used. A small strip of the agar or jelly was removed to a thin glass slide inverted on the moist chamber under the microscope, and the desired colony located and removed.

Colonies isolated in this manner were grown in the same kind of liquid media used in the beginning of the experiment. It was found more difficult to isolate *Nitrosomonas* than *Nitrobacter* organisms. In pure culture these organisms may be cultivated for a long period of time without any loss of power to oxidise ammonia or nitrite nitrogen. The source of these nitrifying bacteria apparently had no effect on their characteristics, since the morphology and physiology of the organisms obtained from the three different soil types were the same.

13 - Effect of Carbon Dioxide Gas on Bacterial Numbers, Ammonification, and Nitrification. — NOYES, A. and YODER L. (Scientific Proceedings of the Society of American Bacteriologists), in *Abstracts of Bacteriology*, Vol. II, No. 1, p. 3 Baltimore 1918

In a greenhouse experiment seedlings were subjected to carbon dioxide gas treatments over a period of 9 months. The pots in a first series received no carbon gas treatment, those in a second series received carbon dioxide gas treatments at the rate of 640 cc. per hour per pot for eight hours each day, while those in the third series received carbon dioxide gas treatment at the rate of 640 cc. per hour per pot continuously. Bacteriological tests were made at the end of the investigation using samples of the unaerated soil directly from the pots.

The results of these tests are given in the following table :

	I No carbon di- oxide treat- ment —	II Eight hours carbon di-o- xide treat- ment	III Continuous carbon di-o- xide treat- ment —
Bacterial number after 10 days incubation	101.0	103.2	111.3
Ammonification	100.0	98.2	98.2
Nitrates in soil before incubation	100.0	102.3	154.2
Nitrates in soil after incubation	100.0	97.4	86.2

- 14 - **The Potassium Requirement of Nitrogen-fixing Bacteria.** --- KOCH, G. P., in *Soil Science*, Vol. V, No. 3, pp. 219-224 + Bibliography of 20 Publications, Baltimore, March, 1918.

It has been shown that potassium is one of the inorganic cations essential to nitrogen-fixing bacteria. The author attempted to determine the extent to which potassium constitutes this essential factor under experimental conditions of physical control. For the experiments were used peptone cultures to which were added salt mixtures in varying proportions. These were compared with cultures in which the salt mixture contained no potassium and control cultures of peptone only.

The results of the experiment show potassium to be necessary to the development and activity of *Bacillus subtilis*. If the amount of potassium present is not sufficient for the bacteria the magnesium sulphate and calcium phosphate contained in the salt mixture have no influence and cannot be utilised by *B. subtilis*. The addition of 0.24 mgm. of potassium in excess of the 0.10 mgm. already present in the 100 cc. of the dialysed peptone solution represents the amount of peptone required for the maximum development and activity of *B. subtilis*; the addition of two and a half or five times this quantity does not increase the activity of the bacterium. It should be noted that when the same proportion is maintained among the constituents of the salt mixture but the total concentration reduced from 0.10 to 0.09 atmosphere, the formation of ammonia from peptone by *B. subtilis* is not affected.

- 15 - **The Non persistence of Bacterio toxins in the Soil** (1) - HUTCHINSON, H. B., and THAXSEN, A. C. in *The Journal of Agricultural Science*, Vol. IX, Pt. 1, pp. 13-62 + 10 Tables, Cambridge, August, 1918.

As soil contains a considerable bacterial flora and is the seat of numberless bacterial changes, it may be supposed that bacterial toxins form in it. This is one of the most important problems of soil bacteriology, as any depression of cell growth due to bacterial toxins must result in a limited plant production. Of recent years different workers (RUSSELL, GREIG SMITH, etc.), have claimed to have proved experimentally the presence of bacterial toxins in the soil through subjecting to heat soil extracts inoculated with a pure culture of *Bacillus prodigiosus*. Counting the bacteria after a short period of incubation showed the fertility of the extracts to have been greatly increased. Many objections to these results were raised, the chief one being that the workers' conclusion assumed *ipse facto* that all substances exercising an unfavourable influence on the development of the bacteria (in comparative samples not treated by heat) are bacterial toxins, and, in addition, that the various methods of sterilising the soil (heat, antiseptics) decompose or destroy the toxins supposed to be in the soil.

The authors have again studied this question, using seven different soils. They proved that :

(1) See also *R* Sept., 1917, No. 795 (131)

1) The extracts of *untreated* soil varied greatly in their suitability to the growth of the test organism (*B. prodigiosus*).

2) Treating the soil extracts with heat (which, according to the preceding hypothesis, should have destroyed the bacterial toxins) invariably reduced the number of bacteria still further.

3) Soil extracts treated with antiseptics (which are not supposed to destroy the toxins) were, on the whole, more favourable to bacterial growth than those of untreated soils. It had been objected that previous workers (RUSSELL, GREIG SMITH) had used in their investigations a bacterium rarely found in soil (*B. prodigiosus*). The authors, therefore, inoculated soil extracts which had proved least favourable to the growth of *B. prodigiosus* with a micro-organism belonging to the typical bacterial flora of the soil — *B. fluorescens liquefaciens*. No toxic symptoms were observed, on the contrary, abundant growth resulted.

CONCLUSIONS. — Exceptional results which do not agree with those of the authors (one case only in their investigations) must be accepted with reserve when they concern a bacterium foreign to the common bacterial flora of the soil, such as *B. prodigiosus*. At present it cannot be affirmed that bacterial toxins take part in the partial sterilisation of soil.

16 - **Sampling Field Plots for Bacterial Analysis.** — I NOYES, H. A. (Scientific Proceedings of the Society of American Bacteriologists), in *Abstracts of Bacteriology*, Vol II, No 1, p 3 Baltimore, 1918 — II NOYES, H. A. and VOIGHT, E., *Ibid*, pp 3-4.

I. — *Method of taking soil samples for bacteriological analysis.* — In taking soil samples for moisture and chemical work from experimental plots many investigators take a large number of samples, mix them, and analyse the resultant mixture. Other investigators select a number of spots that are apparently representative of the soil, the crop, and the treatment under study and analyse each sample individually. This latter method brings out the variations at the spots studied and subsequent samplings from these same spots vary mainly as the fertilisation, cropping, and the cultural practices tend to increase or decrease variations.

In bacteriological work it is not feasible to take the large number of samples that would be necessary so that the analysis of a mixture might fall within the limits of experimental error. The most satisfactory method is to select for bacteriological study those spots which show uniformity in chemical tests. Samples are taken at regular intervals, care being taken not to sample where the previous sample has impaired the cultural practice under investigation. The samples are analysed individually and the change in the differences between samples is studied more closely than the change in plot averages. The following correlations are apparent: — 1) results can be correlated with differences in the aeration of the plots more than with any other factor, 2) the smallest variations occur where there is uniform average ranking of the place sampled; 3) where a cultural practice or fertiliser treatment is changing the organic matter in the soil the change is in the same direction on all spots chosen by this method.

II. — *Weight of Field Soil Necessary to be taken for Bacterial Analysis.* —

As soils are not composed of equal sized particles or of particles of the same material, a small sample of soil is not representative. These factors make it obvious that no two samples of soil are exactly alike. If the size of the portion of soil taken for analysis is decreased beyond a certain point a small proportion of the larger, rocky particles must necessarily account for a larger percentage of the weight and cut down the area of the soil particles in the sample taken. If air-dry samples could be used the aliquot required to be representative would be smaller than that required from a moist field sample. It has not been proven advisable to use air dry samples and so aliquots of the moist field soil are used.

Among those things which make a large portion of field soil necessary are :

- 1) Since tests for moisture determinations on a silty clay soil, taking aliquots from the sample jars as they came from the field, required 10 gm. portions to have the duplicates check regularly to 0.1 of 1%, and since tests with a coarse sandy soil have shown that it is necessary to use as much as 30 gm to get reliable moisture checks, and further since the bacteria must be distributed in the sample more or less relative to the internal surface and composition of the sample, we are forced to conclude that it would take larger portions of soil to get good bacteriological results than it would for good moisture results.

- 2) Where the ground is covered with plants and their roots are incorporated in the surface soil, it is evident that a large sample must be taken to represent the soil

- 3) When the soil is frozen it is harder to mix the samples and a large aliquot must be taken to overcome inaccuracies in attempts at mixing

The amounts of soil used by investigators were noted to be so different that a questionnaire was sent out to different investigators to ascertain the amounts of soil taken for bacteriological examination in different laboratories

The questionnaire included other materials than soil and the following questions were asked

- 1) How many grammes or cubic centimetres of the materials would you use ?

- 2) How much sterile water would you put this amount of material with to make the first dilution ?

From the data reported it is evident that there is no agreement among different investigators as to the amount of soil to use. Investigations made by the writers warrant the following conclusions

- 1) More than 50 gm of fresh field soil has not been found to increase agreement between triplicate tests, less than 40 gm. has caused large variations with some soils and less than 25 gm of fresh field soil has not been found satisfactory.

- 2) The standard adopted by the writers is 50 gm of field soil mixed with 20 cc of sterile distilled water to make the first bacterial dilution.

- 17 - Preliminary Note on Soils Intended for Tea-Growing in Java and Sumatra. — DEUSS, J. B., in the *Mededeelingen van het Proefstation voor Thee*, No. LV, pp. 1-28 + figs. Batavia, 1918.

The author calls attention to the insufficiency of chemical analysis alone for determining the cultural value of land. The use of mechanical analysis and ATTERBERG's method (1) together with the usual chemical analysis give more satisfactory results.

A brief description is given of the various analytical methods. The method described by MOHR was used for the mechanical analysis. In India only 6 fractions are made instead of 10 as at Java. But the results obtained can be compared if some of the fractions obtained at Java are united. So far ATTERBERG's figures have not given any noteworthy results, but the available data is insufficient. The author briefly describes the changes taking place in the soil, using MOHR's study on Javanese soils as a basis. Attention is directed to the lower black layer found here and there which is completely sterile in spite of its fine black colour; it is probably an old layer of humus buried under volcanic ash during an eruption.

Some of the results obtained are examined in detail. On grouping the soils analysed in a triangle, it is seen that all the easy-working soils are together in one of the angles, the soils hard to work being found in the opposite angle. It is remarkable that the Sumatra tea soils form an entirely separate group; they are rich in feldspar and quartz.

In conclusion the author sums up data on the presence of toxins in the soils and suggests that no alarm need be felt as the researches so far carried out have given results that are not at all convincing.

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- 18 - The "Integral" Method for the Growth of Cereal Crops. — PEQUITO REBELLO, J., in *Novos Métodos de Cultura*, pp. 272 + 29 Plates. Lisbon, printed by "A. Editora Lda." 1917 — II. *A Vinha Portuguesa*, Year XXXIII, No. 10, pp. 261-263. Lisbon, October, 1918.

The author describes the method devised and applied by him, which consisted in uniting a number of improved methods of cultivation advised (some a long time ago) by eminent experts and successful farmers. He describes these methods discussing them separately: -- early and thin sowing made with well-chosen seed (HALLER method), repeated shallow cultivation between the rows to keep the soil fresher, and moister at a depth (Algerian or BOURDIOI method), an improved, worked summer fallow (JEAN (2) method); sowing in small furrows that are filled up and rolled to encourage tillering (DEMTCHEVSKY method). The author's method which, for this reason is called "integral" consists in the following operations: -- 1) early sowing, after September, 2) choice of a variety with high tillering powers and very resistant to rust; 3) sowing in lines about 32 in. apart, with only $\frac{1}{3}$ the quantity of seed usually sown in the locality where the integral meth-

(1) Method for determining soil cohesion in which its fluidity, adhesiveness and plasticity in relation to its water content are determined. See Vol. 2 of ATTERBERG's *Die Plastizität der Tone*, in *Int. Mitt. f. Bodenkunde*, I, No. 1, 1911; see also *R*, 1913, No. 1239.

(2) See *R*, February 1916, No. 386. (Ed.)

od is being applied; 4) sowing on furrows in the bottoms of which is put the manure or fertiliser and then the seed, which is covered with a shallow layer of soil so that the furrow in which the plant will appear remains open; 5) during the first stage of growth, hill up slightly once or twice, topping once or twice, and roll one or more times, which will result in greatly stimulating tillering and the development of adventitious roots, 6) during winter, profiting from the wide spaces between the lines, a few small furrows are opened along side each row of cereal to help surface drainage; this operation can be combined with hilling up; the field is so arranged that the plants grow on the crest of a small ridge, leaving a larger and higher ridge in the midst of the space between the rows, 7) repeated harrowings should be given in spring, so that the field will be covered with a fine layer of soil that will prevent drying up and the growth of weeds; 8) in the following year, the same cereal, or that following in the rotation, will be sown in the space between the lines, where the soil has been rested and is yet perfectly prepared just as if it had been a cultivated fallow.

The author tested his method on his estate at Alemtejo with poor, tertiary soil, where ordinary methods hardly produce 8-9 bush. of wheat per acre, he obtained 11.1 bush, without needing a fallow and with a saving of 43 pints of seed and 178 lb. of superphosphate per acre. He states that he obtained an income of 70 *milreis* per hectare (£6 6s. per acre) in a district where the sale price of land is rarely more than 10 *milreis* per hectare (about 11 per acre).

The integral method was also tried in the north of Portugal. In the "Posto Agrario" of Minho Litoral 45 bush. per acre were obtained with a quantity of seed equal to 56 % of that usually sown, whilst the crop grown by ordinary methods had never been more than 11.1 bush per acre, fine ears were obtained.

In the district of Caldas das Taipas, a well-known agriculturist, Dr. S. GARCIA, tried the method, and obtained a yield of 575 fold with rye and 126 fold with wheat. The latter formed tufts having as many as 130 stems and very fine ears, there was a saving of both seed and fertiliser.

19 - The Use of Explosives in Agriculture. — See No. 67 of this Review

20 - The Chemical Effects of Applying Lime to the Soil. — I. HOAGLAND, D. R. and CHRISTIE, A. W. (Division of Agricultural Chemistry, California Agricultural Experiment Station), The Chemical Effects of CaO and CaCO_3 on the Soil. Pt. I The Effect on Soil Reaction, in *Soil Science*, Vol. V, No. 5, pp. 379-382 + Bibliography of 7 Publications. Baltimore, Md., 1918. — II. CHRISTIE, A. W. and MARTIN, J. C., The Chemical Effects etc. Pt. II The Effect on Water-soluble Nutrients in Soils, *Ibid.*, pp. 383-391 + Bibliography of 13 Publications.

I. THE EFFECTS OF CALCIUM OXIDE AND CALCIUM CARBONATE ON SOIL REACTION. — For some time this question has aroused great interest among agriculturists in connection with the form in which lime should be applied to the soil as a fertiliser. It is known that quicklime (CaO , CaO_2H) is sometimes injurious immediately after application even if it be admitted that carbonation takes place so rapidly that its ultimate effect is the same

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as that of the application of calcium carbonate (CaCO_3). Nevertheless the authors considered it advisable to make a closer study of these phenomena by using the hydrogen electrode method for determining the hydrogen-ion concentration in soil suspensions.

Three types of soil were used: — 1) clay adobe, 2) sandy loam, 3) silty clay loam. When added to the soil the calcium oxide first caused a strong concentration of hydroxyl-ions, which decreased after a few days and continued to decrease slowly. Nevertheless the treated soils were very alkaline, even after some months, as compared with untreated soils or those to which calcium carbonate had been added. A large excess of calcium oxide may, in certain soils, maintain such a high hydroxyl-ion concentration as to inhibit nitrification. The ultimate effects of calcium oxide and calcium carbonate are not necessarily identical, and more exact observations should be made of the reaction (hydrogen-ion concentration) caused by lime in its chemical and biological effects.

II. — EFFECTS OF CALCIUM OXIDE AND CALCIUM CARBONATE ON THE WATER-SOLUBLE NUTRIENTS IN SOILS. — Three types of soil were examined: 3 sandy loams, 2 silty clay loams, and 1 clay adobe. In some cases the concentration of the soil solution was increased by the addition of calcium oxide, the effects of which were more marked than those of calcium carbonate. The effect of lime on soil depends partly on the previous treatment of the soil, especially on the concentration of its solution. The effect was more pronounced in recently cultivated soils or those with a low initial concentration.

Liming increased the water-soluble potash in two soils only and decreased it in two others. The soluble magnesium content was increased in four soils and decreased in one. The soluble sulphates were increased in four soils. In two soils only was there any appreciable increase in soluble phosphates.

The data concerning the solubility of the nutrients were controlled by determinations of the freezing-point and electrical conductivity.

Conclusions. — All soils do not react chemically to lime in the same manner, and a single soil may react differently according to the different concentrations of its solution due to cropping or fallowing. Though it is not possible to explain the reasons for the changes, it is clear that the addition of lime compounds modifies the equilibrium of the complex soil solution and that the effects are varied and impossible to predict. To explain these phenomena satisfactorily it must be possible to determine all the elements concerned in liming.

21 — **The Effect of Gypsum upon the Solubility of Potash in Soils.** — McMILLER, P. R. (Assistant Soil Chemist, Agricultural Experiment Station, University of Minnesota) in the *Journal of Agricultural Research*, Vol. XIV, No. 1, pp. 61-65 + Bibliography of 8 Publications Washington, July 1, 1918

Previous investigations into the solution of potash in soil by gypsum have not been undertaken in the field. The author, therefore, carried out experiments in which soil with which gypsum was mixed was kept for several months under moisture conditions similar to those existing in the

field. This moisture in fine-textured soils in damp districts when evaporation is low and plants absent, is somewhat below the moisture equivalent.

Five different types of loam were used and to each was added 1 % of gypsum and the amount of water necessary to maintain approximately the moisture equivalent. These samples, as well as the controls, were kept in covered flasks, then extracted with water. The potash content of the filtered solutions was then determined by the chloroplatinate method. In the soils to which gypsum had been added there was a considerable increase (almost the double) of the soluble potash content as compared with the extracts of the control soils. The fact that in previous investigations the action of gypsum did not cause such an increase in soluble potash is probably due to the conditions of contact between the soil and the gypsum which differed from those found in the field and reproduced by the author in his experiments.

22 - Manufacture of Superphosphates in British India. — *The Board of Trade Journal* Vol. C, No. 1123, p. 724 London 1918

The following resolutions have been passed by the Board of Agriculture in India, as the result of the report of the Committee appointed to consider the value of local phosphatic manures.

I. That with a view to encouraging the extended use of phosphatic manures, the Board consider that a survey of the resources of the country in mineral phosphates should be undertaken by Government. In view of the vital importance to Indian agriculture of keeping the supply of phosphates at a price within the reach of the cultivator, the Board suggests that control over all the internal mineral sources of supply should be retained by Government.

II. — That in view of the great distance over which manures must be carried in India from the centres of supply to the fields of cultivators, the Board is of opinion that the question of reducing *internal* railway rates charged on such concentrated manures should be considered by the Railway Board.

23 - Twenty Years' Work on the Availability of Nitrogen in Nitrate of Soda, Ammonium Sulphate, Dried Blood and Farm Manures. — LIPMAN, J. G. and BLAIR, A. W. (New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. V, No. 4, pp. 291-300 + 1 Fig. + 2 Tables + 1 Plate + Bibliography of 5 Publications. Baltimore, April, 1918

The problem of the availability of nitrogenous fertilisers has occupied the attention of the principal European experiment stations for about thirty years. About twenty years ago this question began to be studied in America as well and the results obtained there confirmed, on the whole, those of European workers. The authors describe a series of investigations lasting over twenty years (1898 to 1917) made with five-year rotations grown in galvanised iron cylinders set in the earth. The sub-soil used was gravelly sand and the top soil loam. The basic fertiliser was made up of ground limestone, 640 lb. per acre of superphosphate and 320 lb. per acre of potassium chloride. The first rotation, begun in 1898, included : 1) maize, 2) oats or millet, 3) oats or maize, 4) wheat, 5) timothy. The

second rotation, begun in 1903, included the same crops except that the oats might eventually be replaced by maize. The third and fourth rotations were similar to the second except that, in the third, rye and oats were grown together instead of wheat. The nitrogenous fertilisers used were farm manure at the rate of 16 tons per acre of sodium nitrate, 320 lb. per acre of ammonium sulphate and dried blood, each equivalent to 320 lb., of sodium nitrate per acre.

RESULTS. -- The amount of sodium nitrate used gave better results than the equivalent amount of ammonium sulphate or dried blood. During the first ten years these two fertilisers gave results almost equal to those obtained with sodium nitrate, but after this period increased the yield less and less. The average amount of nitrogen recovered in the crops during the twenty years was 62.42 % with sodium nitrate, 47.48 % with ammonium sulphate, 38.69 % with dried blood and 32.69 % with cow manure. Cow manure applied at the rate of 16 tons per acre gave yields slightly superior to those obtained with sodium nitrate, but the difference was not sufficiently great to justify the higher cost of applying nitrogen in this form.

CONCLUSIONS. Sodium nitrate as the sole source of nitrogen can, if suitably supplied, maintain high yields for a long time. Nitrogen supplied in this form is more efficacious than an equivalent amount of nitrogen supplied in an ammoniacal or organic form. The effect of sodium nitrate is to produce larger crops per unit of nitrogen. At the same time the crops leave in the soil a larger quantity of crop residues, so that, when calcium carbonate is added to dissolve them, a sufficient supply of organic matter is obtained to keep the soil in good physical condition.

- 24 - **Investigations into the Oxidation of Sulphur in Soils as a Means of Increasing, the Availability of Phosphates, and into other Associated Phenomena, in the United States.** -- I. LIPMAN, J. G. MACLEAN, H. C. and LINT, H. C., The Oxidation of Sulphur in Soils as a Means of Increasing the Availability of Mineral Phosphates, in *Soil Science*, Vol. I, No. 6, pp. 533-539. Baltimore, June, 1916. -- II. *Idem*, Sulphur Oxidation in Soils and its Effect on the Availability of Mineral Phosphates, *Ibid*, Vol. II, No. 6, pp. 499-538. December, 1916. -- III. LIPMAN, J. G. and MACLEAN, H. C., Vegetation Experiments on the Availability of Treated Phosphates, *Ibid*, Vol. IV, No. 4, pp. 337-342. October, 1917. -- IV. *Idem*, Experiments with Sulphur-Phosphate Composts Conducted under Field Conditions, *Ibid* Vol. V, No. 3, pp. 243-250. March, 1918. -- V. MACLEAN, H. C., The Oxidation of Sulphur by Microorganisms in its Relation to the Availability of Phosphates, *Ibid*, Vol. V, No. 4, pp. 251-290 + Bibliography of 76 Publications, April, 1918. -- VI. AMES, J. W. and RICHMOND, T. E., Sulfification in its Relation to Nitrogen Transformations, *Ibid* Vol. V, No. 4, pp. 311-321. April, 1918. -- VII. LIPMAN, C. B. and GERICKE, W. F., The Significance of Sulphur in Sulphate of Ammonium Applied to Certain Soils, *Ibid*, Vol. II, No. 1, pp. 81-86. January, 1918 (1).

The transformation to sulphates of elementary sulphur in the soil was reported by MARÉS as early as 1869. Since then especially of recent years,

(1) See also *R. May*, 1912, No. 780; *R. July*, 1913, No. 784; *R. Nov.*, 1914, No. 979; *R. March*, 1918, No. 264 (*Fd*).

many investigations have been made in Europe and America into the use of sulphur as a fertiliser in practical agriculture, special attention being given to the oxidation it undergoes. Until these last few years sulphur and its compounds were not considered essential constituents of ordinary fertilisers and elementary sulphur was used only in experiments, which became very numerous owing to the contradictory results obtained by different workers (some reporting beneficial effects, some injurious effects and some the complete absence of any effect at all), and the yet greater divergences in the explanations given of the action of sulphur in soil. These investigations, however, show the importance of problems concerning the sulphure requirement of plants, the eventual absence of this element in soil and its application as a fertiliser. No less important from a scientific point of view is the study of the influence of sulphur on the development of plants and micro-organisms, as well as of the theory of this action.

The investigations described in papers I, II and III on the *oxidation of sulphur in soils and its effect on the availability of mineral phosphates*, show the oxidation phenomena, to which the authors give the generic name of "sulphofication", to be due essentially to micro-organisms. The first result obtained proved the oxidation of sulphur in sand and soils to make the phosphoric acid of the raw mineral phosphates soluble in neutral ammonium citrate and even, to a certain degree, in water. The maximum solubility, after 30 weeks, was observed in silt loam + mineral phosphates + sulphur, in which 85 % of $P_2 O_5$ was rendered soluble. In sand, as well as in soil, the oxidation of sulphur is measured by the formation of sulphates which corresponds to the increase in available $P_2 O_5$. Moisture is an important factor in the oxidation of sulphur and consequently, in the solubility of raw phosphates. Vegetation experiments showed that compost similar to that mentioned above may be used as a substitute for superphosphates.

In support of this conclusion the field experiments made in porous earthen pots sunk in the ground, described in paper IV, show that, even under field conditions the composts already described may be used to make the phosphoric acid of mineral phosphates available. Moreover, under suitable aeration conditions, temperature is an important factor in the oxidation of sulphur, so that, to obtain the best results with these composts, they should be made up in warm weather. Experiments made with a mixture of 3 parts of raw mineral phosphate + 1 part of flowers of sulphur + 6 parts of soil, showed the largest quantities of available $P_2 O_5$ to be at a depth of 3 to 4 inches.

The investigations mentioned so far are of a preliminary nature only and some of the data are rather uncertain. The author of paper V therefore considered it necessary to undertake new experiments on the various factors and conditions influencing the *oxidation of sulphur by micro-organisms and the solubility of raw phosphates*. These experiments show the most economical mixture for the production of available $P_2 O_5$ to be one of 10 parts of soil + 12 parts of sulphur + 40 parts of raw phosphate. An appreciable quantity of $P_2 O_5$ is rendered available even without the use of soil. Of the three mineral phosphates used (Tennessee brown rock, Tennessee

blue rock, and Florida soft rock), the third proved preferable, giving a high yield of available P_2O_5 in the composts containing sulphur. Finely-ground phosphates favour the contact of the various constituents, and are advantageous so long as they are not so fine as to inhibit biological activity by insufficient aeration. The biological factor — *action of micro-organisms* — is preponderant in sulphification and the dissolving of the P_2O_5 of raw phosphates. All other conditions being equal the quantity of P_2O_5 made available in inoculated composts in 9 weeks was double that made available in 30 weeks in uninoculated soils. In preparing these composts special attention must be given to aeration as most of the bacteria which oxidise the sulphur are aerobic, i. e. require much oxygen.

Of the various catalytic agents tested, sulphates of ammonia, calcium, magnesium and zinc had no influence on the oxidation of sulphur, whereas sodium nitrate, potassium iodide and copper sulphate had a depressing action. The addition of 0.2 % of sodium nitrate inhibited the process almost entirely. Under certain conditions ferrous sulphate, aluminium sulphate, and a mixture of these two salts had a marked stimulating effect on the oxidation of sulphur when present in small amounts in a compost of soil + sulphur + ground Tennessee brown rock phosphate. As the stimulating action of a mixture of these two salts exceeds that of either used separately, it would be advisable in practice to add to each ton of compost 0.4 lb. of ferrous sulphate and 0.4 lb. of aluminium sulphate in order to obtain the maximum production of available P_2O_5 . The addition of calcium carbonate may decrease the yield of available P_2O_5 in the composts, whereas the presence of soluble phosphoric acid does not influence this yield.

A compost similar to that already described produces available P_2O_5 more actively when it contains little organic matter (peat, fresh horse manure, old composted manure, peptone) the action of which is more unfavourable the more soluble it is. This accounts for the unsatisfactory results obtained with a mixture of raw phosphates and decomposing organic matter, and leads to the conclusion that the action of the bacteria oxidising sulphur in the soil is, from this point of view, similar to that of nitrifying bacteria. When peptone was added to a compost, most of the sulphur was transformed into *sulphites* instead of sulphates.

The authors of paper VI sought to determine whether the acidity produced by the oxidation of sulphur in the soil has, in addition to a dissolving action on the mineral elements nourishing the plants, an effect on the *transformation of nitrogen* in both acid and basic soils. During 17 weeks 50 duplicate bacterial cultures were made in the following soils: — a) silt loam deficient in calcium and organic matter; b) decidedly basic black clay; c) peat. These soils were kept at 60 % of their water-holding capacity, and to them were added 1 % of flowers of sulphur, 1 % of raw phosphate, casein supplying 0.5 % of nitrogen, and calcium carbonate in proportions to the acidity of the soil.

The results showed that in soils devoid of alkaline substances, the oxidation of sulphur reduces the activity of nitrifying bacteria. When the

soil had received an excess of calcium the nitric nitrogen yield of the casein was much decreased by the oxidation of the sulphur added, but there was a corresponding increase in ammonia. As a general rule the less calcium the soil received, the lower was the yield in nitric nitrogen, so that there appears to be a quantitative relation between the production of nitric nitrogen and the amount of calcium added to the soil. These results show that sulphofication not only tends to increase the acidity of the soil and the solubility of its mineral constituents, especially the phosphates, but also influences nitrogen transformation in both basic and acid soils, in that it favours the formation of ammonia rather than that of nitrates. The greater proportion of ammonia must not, however, be attributed to any stimulating effect of sulphofication on the formation of ammonia, but more probably to the absence of the bases necessary to neutralise the sulphuric acid produced by the oxidation of the sulphur. Under these conditions ammoniacal nitrogen cannot pass into the nitric state but it neutralises the sulphuric acid, thus forming ammonium sulphate.

These facts increase the interest of paper VII which deals with the *action of the sulphur in ammonium sulphate applied to certain soils*. The authors had observed the superiority of ammonium sulphate over sodium nitrate, calcium nitrate, and dried blood for the production of barley in certain Californian sandy soils, and sought to determine whether this was attributable to the sulphur in this sulphate. Barley was grown in soil of this kind kept at its maximum water-holding capacity and divided among 4 series of glazed earthenware jars containing, 1) soil mixed with the various nitrogen fertilisers tested [$(\text{NH}_4)_2\text{SO}_4$, NaNO_3 , $\text{Ca}(\text{NO}_3)_2$ and dried blood], 2) soils containing, in addition to these nitrogenous fertilisers, sulphur in different forms (flowers of sulphur, sulphuric acid, sodium sulphate) in quantities corresponding to that of the sulphur contained in ammonium sulphate, 3) control with neither nitrogenous fertiliser nor sulphur, 4) control without nitrogenous fertiliser but with sulphur.

In the pots with ammonium sulphate the yield in dry matter was about 14 times higher than in the controls to which it had not been added and about double that of the pots with only NaNO_3 , $\text{Ca}(\text{NO}_3)_2$, or blood. The addition of sulphur in all its forms, without nitrogenous fertiliser, had no effect on the yield in dry matter. Sulphur applied in conjunction with nitrates or blood increased the dry matter more than did these fertilisers applied singly, and almost as much as ammonium sulphate. These experiments show the effect of sulphur added to nitrates or blood and confirm the authors' hypothesis that the superiority of ammonium sulphate to other nitrogenous fertilisers for barley in the soil tested is due to the sulphur of the sulphate.

25 - Investigations into the Effect of Boron on Crops and its Distribution in the Principal Plants and in the Soil of Different Parts of the United States. T. COOK and WILSON, J. B. (Animal Physiological Chemical Laboratory, Bureau of Chemistry, U. S. Department of Agriculture), Boron: Its Effect on Crops and its Distribution in Plants and Soil in Different Parts of the United States in the *Journal of Agricultural Research*,

Vol. XIII, No. 9, pp. 152-470 + Bibliography of 8 Publications Washington, May 27, 1918. — II IDEM, Idem, in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 3, *Proceedings of the American Society of Biological Chemists*, XII, *Annual Meeting*, pp. VI-VII. Baltimore, 1918 (1).

The authors had previously shown that borax and colemanite (calcium borate) are efficacious in destroying house fly larvae. They now report the results of their investigations into the effect on plant growth of manure treated with boron to destroy fly larvae. During three years they made experiments on crops in different parts of the United States with manure containing given quantities of borax and colemanite, in order to determine the effect of the boron on the plants. The crops studied were wheat, rye, oats, beets, tomatoes, lettuce, soya, string beans, potatoes, spinach, cabbage, turnip, maize, and peach.

Practically the same quantity of boron was absorbed by the plants whether it was added as soluble borax or insoluble colemanite. Barley, oats and rye absorbed little boron, whereas, the vegetables absorbed a comparatively large amount. A marked difference was observed in the distribution of the boron in the roots, green parts, and fruit of the different plants. Leguminosae are very sensitive to boron. In a soil containing 0.0044 % of boric acid added in the form of borax and 0.0058 % added in the form of colemanite in the upper 6 inches, lettuce, spinach and cabbage were not damaged, but, in another soil, 7 miles away, the same amount of boron decreased the yields of the same plants. Similar differences were noted in the effects of definite quantities of boron on other plants in different soils. The various soils act differently in rendering the boron non-toxic, although all the soils tested made it gradually insoluble and, consequently, harmless. In many soils the plants have a tendency to absorb the boron in proportion to the amount added to the soil, whereas, in others there is no relation between the amount of boron added and that absorbed. The absorption and toxic action of boron on plants vary according to the different plants, the solubility of the boron compounds, the amount of these compounds added to the soil, the time which elapses between the application of the compounds to the soil and planting, the rainfall, and the character of the soil to which the boron is added.

26 — **Observations on the Medlar Tree Flower and the Origin of the Stoneless Medlar in Italy.** — PIERPAOLI, I., in the *Rendiconti della Reale Accademia dei Lincei*, Vol. XXVII, Pt. 3, pp. 121-125. Rome, 1918

Observations made on specimens of the medlar tree (*Mespilus germanica*) grown in the garden of the Botanical Institute of the University of Rome.

CONCLUSIONS. — 1) Between the normal medlar and the stoneless medlar there are all the degrees of transition due to a) the successive reduction of the constituent parts of the pistil which gradually loses the stigmata, style, ovules, ovary and pericarp, b) the successive reduction, to vanishing point, of the number of pistils, the total absence of which also causes the

(1) See *R. Aug.*, 1916, No. 951 (*Id.*)

absence of the inherent secondary characters, such as the downy areas on the surface of the expansion of the receptacle and the yellow halo of the stamens on the edge of the receptacle.

2) In consequence, the stoneless medlar seems to have originated through the successive reduction of the pistils up to their complete disappearance and through the artificial reproduction of the germs which showed this character for the first time

27 - On *Cystopteris alpina*, a Fern Containing Hydrocyanic Acid. — MIRANDI M. in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 19 pp. 675-676 Paris, November 4, 1918

In the Fern family only a few plants are as yet known to contain hydrocyanic acid (*Pteris aquilina*, *Gymnogramme aurea* and *G. cordata*, *Lastrea* sp. and *Athyrium* sp.). The author has found that a cyanogenetic glucoside is present in *Cystopteris alpina*, a fairly common fern of the Savoy and Dauphny mountains. This glucoside, which belongs to the amygdalin group is present in the green aerial organs (leaves) during their life but the amount present, fairly large at the beginning of the season, gradually decreases. Samples collected in the beginning of September contained 0.01107 gm. per 100 of fresh plant.

28 - Production of Glyocol by *Isaria densa*. — BONNIER, G., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 22, pp. 786-788 Paris, November 25, 1918

The formation of prismatic crystals, grouped radially, is of fairly common occurrence in old cultures of various bacteria or lower fungi on gelatine media. The author has noted this to occur with special intensity in cultures of *Isaria densa* (1), the crystalline substance produced being glyocol. Starting from the most varied forms of protein this Mucidineae forms a considerable amount of glyocol, and the yield, amounting to $\frac{1}{2}$ of the substances transformed, enables the biological conditions of this, production to be used for the preparation of glyocol.

29 - Physiological-chemical Studies on the Soybean. — I SHIVE, J W (Plant Physiology Laboratory, New Jersey Agricultural Experiment Station), Toxicity of Monobasic Phosphites towards Soybeans Grown in Soil and Solution-Cultures, in *Soil Science* Vol. V No. 2, pp. 87-122 + 51 Figs. + Bibliography of 16 Publications. Baltimore, February, 1918. — II WOLKOFF, M. I. (Rutgers College), Effect of Ammonium Sulphate in Nutrient Solution on the Growth of Soybeans in Sand Cultures. *Ibid*, pp. 123-150 + 71 Figs. + Bibliography of 23 Publications.

I. TOXICITY OF MONOBASIC PHOSPHATES TOWARDS SOYBEANS GROWN IN SOIL AND SOLUTION CULTURES. — The experiments dealt with the influence of the monobasic phosphates of sodium, ammonium, calcium and magnesium on the growth of the soybean, special attention being given to any symptoms of toxicity occurring during the different stages of the experiment. There were three distinct experimental series: a) soil cultures to which the different soils were added separately in solutions of

(1) The entomophyte in question was obtained from mummified pupae of *Zygaena occitanica*. (Author).

varying concentration ; *b*) as in *a* with the addition of a complete fertiliser in the form of solutions of constant concentration ; *c*) complete nutritive aqueous solutions.

Result. — **SERIES *a***. The growth of the soybean tops was injured by each of the five monobasic phosphates applied in solutions with a concentration varying from 0.5 to 7 atmospheres of osmotic pressure. The injury, identical in each case and attributable to the radical bi-acid (H_2PO_4), occurred when the osmotic concentration of the solution applied exceeded 1 atmosphere. The phosphates were toxic in the following decreasing order : mono-potassium, mono-ammonium, mono-magnesium, mono-sodium.

SERIES *b*. The phosphates were markedly injurious even when applied together with a complete fertiliser, but did not kill the plants. The extent of the injury was not determined by the phosphate content only, but also by the relative proportions of the other salts applied.

SERIES *c*. In the aqueous solutions toxicity occurred in the following decreasing order : mono-sodic, mono-ammoniacal, mono-potassic, mono-magnesian and mono-calcic phosphates. The acidity of the solutions is definitely related to the specific injury suffered by the plants growing in these solutions, for, the higher the acidity, the greater is the injurious effect on the plants. Nevertheless, even in the solutions, the respective proportion of the salts has a marked influence in increasing or decreasing the injurious effect due to the acidity of the solutions.

In soil cultures there is no exact relation between the injurious effect and the yield, whereas in solution cultures the yield is in inverse proportion to the injury. The complexity of the problem studied makes it impossible to apply the conclusions obtained to other than experimental conditions or to plants other than the soybean in the first stages of its growth.

II. - EFFECT OF AMMONIUM SULPHATE IN NUTRIENT SOLUTION ON THE GROWTH OF SOYBEANS IN SAND CULTURES. — In these sand culture experiments ammonium sulphate took the place of potassium nitrate in a series of TOTTINGHAM nutrient solutions (mixture of mono-potassic phosphate, potassic nitrate, calcic nitrate and magnesian sulphate).

Results. — Ammonium sulphate gave better results than potassium nitrate when used in given saline proportions, but caused marked injury when applied in excess. It gave a deeper green foliage than potassium nitrate. There was a close relation between top production, root production, and the total production of the plants. The amount of water required to produce 1 gm. of dry matter in the form of soybean buds was less with ammonium sulphate than potassium sulphate.

30 - **The Influence of Certain Organic Substances on Plants.** — CIAMICIAN, G. and RAVENNA, C., in the *Gazzetta chimica italiana*, Year XLVI, Vol. 1, Pt. 1-6, pp. 253-304 + 7 Figs. Rome, 1918

In a previous paper (1) the authors described experiments on the influence of various organic substances on the germination and growth of

(1) See R., Dec. 1917, No. 1136. (Ed.)

plants, and the auto-oxidation that certain compounds might be subjected to under the action of the catalysers present in plant organisms.

In the present paper, the description is given of another series of researches, divided into three parts : — 1) the action of some substances on germination ; 2) the presumable auto-oxydations ; 3) the elimination of certain compounds by the aerial parts of plants. The results are collected in tables, followed by a discussion.

The results obtained in the first group of researches make the hypothesis very probable, according to the authors, that alkaloids play a part as yet unknown, but well determined, in the plant which might be that of plant " hormones ". " The various plant species, by employing waste products that are not utilisable as they are (e. g., xanthine), appear to change their composition in such a way as to fit them to undertake the specific functions (1) required of them."

In this way it can be understood how plants, starting from simple products like pyridine, can produce more complex alkaloids, and how they produce, with the aid of xanthine, which is both unutilisable and inoffensive, the methyl derivatives of this compound, which have a special physiological action.

The experiments described in the second part of the paper show (using as basis control tests in an atmosphere of carbon dioxide) that the disappearance of certain compounds from spinach leaves in an atmosphere of oxygen, caused by the enzymes in the leaves, is really due to an oxydation process.

In the third group of researches the authors found that pyridine and nicotine inoculated into maize plants are eliminated by the leaves.

31 — **The Action of X-Rays on the Germination of Barley.** — See No. 6 of this *Review*.

32 * **Effects of Hybridisation on the Productivity and Earliness of Maize, in Connecticut, U. S. A.** — JONES, D. F., HAYES, H. K., SLATE, W. I., and SOUTHWICK, B. G., in the *Fortieth Report of the Connecticut Agricultural Experiment Station*, pp. 323-347 + 2 Plates + Bibliography of 15 Publications. New Haven, 1917.

This bulletin gives the results of a series of investigations made from 1914 to 1916, at the agricultural stations of Mount Carmel, Storrs and New Haven, Connecticut on 51 F_1 hybrids. The most important of these results are : —

EFFECTS OF HYBRIDISATION ON PRODUCTIVITY. — In 66%, of the cases the grain yield of the hybrids exceeded that of each of the parent plants, in 22 % of the cases it exceeded the average yields of the parents, in 8 % it was below this average, and in 4 % was below the yield of each of the parents. The greater vigour of the hybrids, therefore, has a positive influence on productivity. For hybridisation to succeed in a given district it is, however, necessary for the yield of the hybrids to exceed not only that of the more productive parent, but also that of the best varieties grown in the district. For this reason the New Haven Agricultural Station has, dur-

(1) See *R.*, August, 1918, No. 853. (Ed.)

ing the last 5 years, always compared the F_1 crops with the best known varieties of maize, and in every case the former have done best.

EFFECT OF HYBRIDISATION ON EARLINESS. -- In maize hybrids the duration of the vegetative period is equal to the average of these periods of the two parent plants. In a district such as Connecticut, where the shortness of the frost-free season makes it essential to grow early-ripening plants, this fact is of paramount importance, and, as the hybrids often surpass the most productive parent both in yield and earliness, their area of distribution may be greatly extended. In 1916 the hybrid Howe's Connecticut Dent \times Burwell's Yellow Flint had a grain yield exceeding that of the first parent by 13.6 % and, at the same time, ripened one week earlier. On the other hand, Funk's 90 Day \times Burwell's Yellow Flint is slightly inferior to the second parent in grain yield but ripens twelve days earlier, an enormous difference from a genetic point of view and of great importance in districts with a short frost-free season.

CONCLUSIONS. — Hybridisation of maize is very advantageous because it makes it possible to unite productivity and earliness in one plant. The best results were obtained with the following crosses : —

'Tyler's White Cap Dent (1) \times Burwell's Flint (2).

Harris' Early Huron \times Burwell's Flint.

Howe's Connecticut Dent \times Burwell's Flint.

Montgomery's Dent \times King Phillip Flint.

Brewer's Dent \times King Phillip.

Brewer's Dent \times Burwell's Flint.

It should be pointed out that the grain yield of hybrids exceeds the average of the yields of the two parents to a greater extent the greater is the difference between their characters, origin, etc. Thus, the cross Dent \times Flint is much superior to the cross Flint \times Flint.

Up to the present the vigour characteristic of hybrids has been attributed to heterozygosis, but recent work (JONES, 1917) has shown that it might be due to the hybrid's accumulating the growth factors of the parents, thus possessing more of these factors than each parent separately. In the cross Dent \times Flint, Dent maize may supply the factors absent in Flint maize, and vice versa, so that the factors contained by the hybrid form a more complete whole than is the case with the parents, and have thus greater vigour. It has been objected that, if this point of view is correct, it should be possible to unite in one variety, under stable and homozygous conditions, all the factors of growth scattered amongst the different varieties of one species. In reality, however, no variety (of maize or other naturally staurogamous plant) is known in which this stable and homozy-

(1) Dent Maize (*Zea Mays* var. *indentata* [Sturt] Bailey) is characterised by grain ridged at the top and with a hard endosperm on the two lateral sides only, the starch portion extending to the tip. (Ed)

(2) Flint Maize (*Zea Mays* var. *indurata* [Sturt] Bailey) is characterised by grain in which the hard layer of the endosperm completely surrounds the starch portion, thus preventing it from reaching the tip. (Ed)

gous combination is realised. This objection is annulled by the fact that certain characters are transmitted not by isolation, but in groups (linkage). This excludes the possibility of combining some characters independently of others. This is why it is impossible to unite all the desirable characters in one individual (or variety) under homozygous condition which are not subsequently affected by self-fertilisation.

33 - Problems Relating to the Selection of Rice by Pure Strains, in Java. - KOCK, L., in *Teysmunnia*, Year XXIX, Pt. 2, pp. 1-36, Pt. 2, pp. 96-127; Pt. 3, pp. 165-191. Batavia, Java, 1918.

Results of a series of experiments made between 1911-16, at the Buitenzorg Station and in other localities of Java, with the Kowel, Glindorean, Rogol and Solo varieties of rice, in order to ascertain the true practical effect of selection by pure strains. The chief results obtained at Buitenzorg are given below.

KOWEL VARIETY. - Out of 34 pure strains of the first selection, 15 gave, in 1913-14, a yield higher than that of the original plants, 5 an equal and 14 a lower yield. In 1914-15 the cultural tests were limited to the 4 best lines of the 15 mentioned above, under the numbers 11, 13, 23, 24. Three of them, especially Nos. 13 and 34, retained their superiority, while No. 23 gave a lower yield than that of the original plants. In 1915-16 the 2 best lines (Nos. 13 and 34) also gave a negative result.

GLINDOREAN VARIETY. - Out of 35 strains of the first selection, 12 yielded, in the first year, more than the original plants, 6 as much and 17 less. The following year, more or less the same facts were noted as for the Kowel variety, and the superiority of the pure strains diminished rapidly afterwards.

ROGOL VARIETY. - This is noteworthy for the positive results it gave the first year. Out of 61 strains, 53 were better than the original plants. But afterwards, as in the 2 previous varieties, the productivity of the best strains diminished rapidly, so much so that, the fourth year, only one strain (No. 43) retained its superiority.

SOLO VARIETY. - There are 2 forms, Solo I and Solo II. The latter, with plumper seed, was discovered and isolated in 1913. Both varieties behave much in the same way as the Rogol variety.

Comparative cultural tests and selection tests made in 2 other localities, Nyandjoek and Sidoardjo, gave results agreeing fairly well with those of Buitenzorg, and like them, lead to the conclusion that selection of rice by pure strains according to the criteria observed in Europe and America is practically useless in Java.

According to the author, there are two reasons for this failure: —

1) *the large annual variations of the meteorological values*, as a result of which the same strain may give good results one year and bad results the next. Thus the strain Caroline No. 2 was clearly superior to strain No. 5 in 1911-12, whilst in the following year, the inverse took place. On the contrary in the ordinary population, the various properties of the constituent strains tend to compensate themselves, so that the yield tends to remain more or less constant.

2) *The great variability of the soil*, especially in the coastal zone, where the variability of the watercourses produces such an irregular mixture and distribution of the silt that uniform soil conditions can rarely be found, even over small areas. Thus, a pure strain produced and differentiated in a small area responds only to the exigencies of that area; when spread over large areas and taken into soil conditions different from those of its place of origin, it soon loses its characters of productivity.

This observation suggests the interesting problem of mixtures: to sow seeds, not of distinct pure strains but of a mixture of pure strains of the same or different varieties, so as to obtain an adaptability and elasticity equal to that of the ordinary plant populations and, at the same time, greater productivity, together with the progressive elimination of the strains of lesser value.

In 1915-16 the author carried out a series of experiments on these lines, using mixtures in different proportions of seed of a) pure strains No. 12 and 28-35 of the Glindorean variety; b) the Glindorean and Mamas varieties; c) the Mamas and Pandan varieties; d) the Rogol, Pandan and Baok varieties.

During these experiments it was found that, according to the case, artificial mixtures gave results that were either superior or more or less equal, or inferior to those of the original populations or of the strains (or varieties) sown separately.

These contrasts can be explained by the fact that the mixed strains (or varieties) strongly influence each other both as to quantity or as to quality. These reciprocal influences sometimes give a sum of positive effects, at other times a sum of negative effects, whence the diversity of the results obtained.

The system of artificial seed mixtures is, therefore, sound. The question is, in each case, to choose a certain number of strains (or varieties) that do not give rise to a sum of negative effects and are capable of simultaneously providing that the "artificial population" formed by them will have the adaptability proper to "natural populations", which is necessary to maintain a fairly constant yield under very varying condition of soil and climate.

34 - **Pure Line Soybean Selection, in Connecticut, U. S. A.** - JONES, D. F. and HAYES, H. K., in the *Fortieth Report of the Connecticut Agricultural Experiment Station for the Year 1916*, pp. 34-353. New Haven, 1917.

During cultural tests of the Kentucky variety of soybean, imported from Manchuria in 1911, marked individual differences were noted between the plants with respect to manner of growth and the colour of the flowers and pods. In order to obtain more uniform types pure line selection was started in 1913. Twenty-three plants differing widely in number of pods, the shape and number of the seeds, etc. were chosen.

The descendants of the pure strains, unlike the original plants, proved very uniform, especially in the colour of the flowers, pods and seed which remained constant in the successive generation. Other characters, how-

ever, date of flowering, number of pods, length of stem, were subject of variation. The character "productivity", though of necessity subject to the changing action of external agents, sometimes showed differences which appeared hereditary and due to diversity in the specific productivity of the strains and the original plants. The descendants of ten of the highest yielding plants chosen amongst the most productive gave, in 1914, ten descendants, seven of which gave a yield exceeding that of the original plants. This is seen by the amount of seed harvested in bushels per acre: Unselected Kentucky, 25.9; Selection No. 2, 25.6; No. 8, 28.3; No. 9, 30.0; No. 10, 25.7; No. 11, 30.4; No. 18, 26.2; No. 22, 24.2; No. 24, 32.8; No. 25, 29.0; No. 1, 27.0 (average of two cultural tests). The greater productivity of the best lines is, therefore, maintained and transmitted integrally.

Similar selection experiments were also made with the Ito San variety, distinguished for the uniformity of its characters. In 1913 seventeen plants were chosen and the seed of the five most productive sown separately. The yields, in bushels per acre, were: Original Ito San, 22.5; Selection No. 1, 21.2; No. 2, 22.8; No. 15, 22.3; No. 29, 20.08; No. 38, 21.8. It is seen that the yields of the selected lines differ little from that of the original plant.

CONCLUSION. Whereas pure line selection yields no improvement when the material used is stable (homozygous) and uniform (Ito San variety), it is efficacious when applied to mixed plants (Kentucky variety), tending to isolate and propagate better types.

35 - **The Effects of Cross and Self-Fertilisation in Tomatoes.** - HAYES, H. K. and JONES, D. T., in the *Fortieth Report of the Connecticut Agricultural Experiment Station for the Year 1916*, pp. 65-318. New Haven, 1917.

Numerous investigations from the last century onwards have lead to the conclusion that artificial fertilisation repeated from generation to generation causes a progressive decrease in the vigour of the plants, but that the crossing of varieties of fairly different structure gives, in F_1 , hybrids which are often more vigorous than the parent plants. The paper under review gives the results of a series of experiments on the effects of self-fertilisation in the tomato. The varieties used were: - Lorillard, Sutton's Best of All, Livingston's Stone, and Dwarf Champion. The last is distinguished from the others by its earliness, the colour of the fruit (pinkish purple instead of red) and its growth (dwarf). The characters studied were volume of the fruit (deducted from the average weight of the ripe fruit), the number of ripe fruit per plant, and the total fruit yield per plant.

EFFECTS OF SELF-FERTILISATION. -- Determinations were made of the effects on the yield of fruit per plant and the average size of the fruit by calculating these values for the self-fertilised plants, and expressing them in percentages of the corresponding values found in plants not self-fertilised. Thus, in 1914, Livingston's Stone variety gave 20.74 lb. of fruit per self-fertilised plant and 21.08 lb. per non self-fertilised plant, the yield of the former being 98 % that of the latter.

If the effect of self-fertilisation is to decrease the vitality of the species, the value of these percentages should decrease from generation to generation. An examination of data on three generations (1913-1915) of Livingston's Stone and Dwarf Champion, and four generations (1912-1915) of Lorillard and Sutton's Best of All, shows the presumed loss of vitality to occur in the last variety only. This is seen from the following percentages:

A) *Yield in fruit per plant.* -- a) Livingston's Stone, 110, 98, 89; b) Dwarf Champion, 105, 125, 111; c) Lorillard, 102, 114, 111, 107; d) Sutton's Best of All, 111, 97, 90, 87.

B) *Average size of fruit.* a) Livingston's Stone, 104, 112, 107; b) Dwarf Champion, 80, 89, 78; c) Lorillard, 115, 144, 127, 118; d) Sutton's Best of All, 115, 115, 111, 100

In the Livingston's Stone variety self-fertilisation repeated from generation to generation decreases the yield in fruit but increases their volume. The effect is reversed in the Dwarf Champion variety. The Lorillard variety gives just the opposite results to those expected -- an increase in both the yield and volume of the fruit. In these three cases it may be concluded that the only effect of self-fertilisation is to isolate the genetically pure strains which may be either superior or inferior to the original variety. The commercial varieties are not homogenous, but made up of a mixture of different types which self-fertilisation tends to isolate. The decrease in vitality observed in Sutton's Best of All as a result of repeated self-fertilisation may be accounted for by admitting this variety to be heterozygous in many characters and very vigorous for this very reason. Continued self-fertilisation causes: homozygous coupling of the characters, the progressive reduction of heterozygosis, and, consequently, progressive decrease of vigour (productivity).

EFFECTS OF HYBRIDISATION. — From the moment that self-fertilisation has not a negative influence on the plant it is possible to measure the effects of hybridisation by comparing data on the yield of self-fertilised plants with those on the yield of the same varieties crossed amongst themselves. In the hybrid Livingston's Stone \times Dwarf Champion the yield is 15 % above that of the more productive parent, Livingston's Stone. This is seen from the average figures for the four years 1912-1915. — Livingston's Stone 18.82 lb. of fruit per plant, Dwarf Champion 17.03 lb., Livingston's Stone \times Dwarf champion 21.65 lb. This hybrid is also earlier than either of the parents. This is shown by the amount of fruit ripening during the first half of the season (before September 10) expressed in percentage of the total yield: — Dwarf Champion 55 %, Livingston's Stone 41 %, Livingston's Stone \times Dwarf Champion 59 %. On the other hand, the F_1 hybrids of the cross Lorillard \times Sutton's Best of All, yield less than the more productive parent, as is seen by the following yields: — Lorillard 21.53 lb. of fruit per plant; Sutton's Best of All 19.96 lb., Lorillard \times Sutton's Best of All 21.44 lb.

All crosses, therefore, do not give increased yield in the hybrids. When, however, a good combination of varieties has been found, i. e., two

varieties which give more productive plants when crossed, it is certain that this production will be repeated in each case in which the excess in yield is sufficient to justify commercially the process of crossing.

- 36 - **Cucumber Hybridisation Experiments at New Haven, Connecticut, U. S. A.** — HAYES, H. K. and JONES, D. F., in the *Fortieth Report of the Connecticut Agricultural Experiment Station for the Year 1916*, pp. 310-322 + Plate XVII, New Haven, 1917.

The varieties used were Early Russian, White Spine, London Long Green and Fordhook Famous. The last two produce large fruit and vigorous vines. White Spine has medium sized fruit and vines, and Early Russian is small, produces a large number of male and female blossoms and tends to set fruit in clusters.

Positive results were obtained with the following crosses: Early Russian \times White Spine, White Spine \times London Long Green, London Long Green \times Fordhook Famous, Fordhook Famous \times White Spine. The increased vigour of the F_1 hybrids is seen both in the weight of the fruit and the total number of fruit per plant, whereas in length they are intermediate between the two parents.

The hybrids Early Russian \times White Spine gave a crop equal in weight to that of the more productive parent. The hybrids White Spine \times London Long Green exceeded the more productive parent in yield by 24%, and Fordhook Famous \times White Spine by 39%, whereas London Long Green \times Fordhook Famous cross gave a yield about equal to that of the parents. The greater vigour of the hybrids appears yet more in the total number of fruit per plant than in their weight. In each case the hybrid was superior to the more prolific parent by an average of 1.6 to 8 fruit per plant, i. e. by 6 to 27%.

- 37 - **Grapefruit Selection in California.** — SHAMET, A. D., SCOTT, L. B. and POMEROY, C. S., in the *U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin No. 607*, 1917, pp. + 11 Plates, Washington, September 27, 1918.

In California the cultivation of grapefruit (*Citrus grandis*) is still limited. It is, however, developing rapidly and, in a little while, will form an important branch of citrus production. From 1910 to 1915 the acreage over which it was grown increased from 894 to 2887 acres, and is still increasing. This development coincided with the introduction of the Marsh Seedless variety which is rapidly replacing the native varieties which yield inferior fruit of low commercial value. The Marsh Seedless variety, a native of Lakeland, Florida, was imported into California by Messrs. TWOGOOD AND CUTLER of Riverside. Not only does it maintain all the characters which make it valuable in the Gulf of Mexico district, but its flavour is superior to that obtained in its native country.

As the other species of citrus, the grapefruit inclines strongly to the production of bud variations which are not only often undesirable, but are usually inferior to the parent plant. At times a lot guaranteed to be commercially seedless is found to contain a more or less high percentage of fruit with 30 to 90 seeds. This type of Marsh fruit is produced from bud variation, and the absence of any judgement in selecting material for graft-

ing has done much to propagate these variations, causing deterioration in both the quality and the quantity of the product.

The study under review gives the results of a series of investigations aiming at : 1) determining the nature and frequency of bud variations in grapefruit ; 2) determining, by means of a series of observations of each plant, the characters of the different variations ; 3) devising methods of isolating the best strains and of showing from which plants grafting material may best be taken. These investigations showed the existence of six well-defined strains :

1) *Marsh strain*. — The most valuable strain commercially by reason of its high yield of first quality fruit ; spreading habit of growth allowing most complete and satisfactory development of crown and branches ; abundant large, elliptical, sharply pointed leaves ; flowers in March and ripens in the summer of the following year ; fruit globular, ends slightly flattened, rind thin ($1\frac{1}{2}$ inch), smooth, ivory white, with amber pulp, juicy and of good flavour ; very few pips (an average of three per fruit).

2) *Seedy strains*. — These varieties differ from the previous one in the drooping growth of the branches, which makes it easy to identify them, and by the presence of 25 to 100 seeds per fruit. In their other characters they resemble the Marsh strain. There are two strains, a rough and a smooth one.

3) *Rough strain*. — Trees erect in growth with a tendency to produce an abnormal number of very vigorous branches ; fruit commercially inferior to those of the Marsh strain, globular, large with thick rind ($1\frac{1}{2}$ inch), rough and yellowish, pulp almost flavourless and with scant juice. The fruit ripens late and irregularly.

4) *Bell strain*. — This strain resembles the previous one, differing only in the shape of the fruit (bell-shaped or pyriform).

5) *Alternate-bearing strain*. — Trees having all the characters of the Marsh strain except in their yield which varies from year to year. There are two groups, one bearing many seeds, the other commercially seedless.

6) *Unproductive strain*. — Low yield, especially in first quality fruit.

Throughout the 1910-1915 period specimens of each of these strains were subjected to special biometrical control in order to determine their good and bad qualities. The fruit of each tree was divided into three grades : — 1) *Ivory white grade*, including the perfect fruit ; 2) *Standard grade*, including fruit imperfect in shape, colour, etc., but saleable ; 3) *Cull grade*, including the unsaleable fruit. A performance register was kept for each tree in which were recorded each year the number and total weight of the fruit, the number and total weight of the fruit of each grade, the average number of pips per fruit, the number of abnormal fruit. This register shows the more or less marked tendency to variation of the different trees and strains. So far the following results have been obtained :—

TOTAL YIELD OF FRUIT PER TREE. — The total number of trees studied was 77, 25 of which were planted in 1898 (Group A) and 52 in 1903 (Group B). The data on the yield per tree are given in a table and include not only each of the strains already mentioned, but also the 5 most productive and the 5 least productive trees, independently of the strain to which they belong.

Group A. — 1) The 5 most productive trees, all of the Marsh strain yielded during the period 1910-1915 an average of 565 fruits per tree, equal to a weight of 441.8 lb.

2) The Rough strain gave per tree 531 fruits and 404.5 lb. respectively

3) Marsh strain, 474 fruits and 381.2 lb. per tree.

4) Rough Seedy strain, 265 fruits and 223.2 lb. per tree.

5) The 5 least productive trees, 261 fruits and 223.0 lb. per tree.

6) Smooth Seedy strain, 248 fruits and 222.4 lb. per tree.

Group B. — 1) The 5 most productive trees, 263 fruits and 218.2 lb per tree.

2) Marsh strain, 195 fruits and 161.6 lb. per tree.

3) Alternate-bearing strain, 191 fruits and 151.5 lb. per tree.

4) The 5 least productive trees, 119 fruits and 99.9 lb per tree.

5) Unproductive strain, 106 fruits and 89.7 lb. per tree.

YIELD OF FIRST QUALITY FRUIT (Ivory white grade). — Marsh strain, 53.5 % of the total yield; Smooth Seedy strain, 49.3%; the 5 most productive trees (all Marsh strain), 48.9 %; Rough strain 45.5 %; the 5 least productive trees, 30 %; Rough Seedy strain, 25.2 %.

AVERAGE NUMBER OF SEEDS PER FRUIT. — Rough strain, 2.2; Marsh strain, 2.6; the 5 most productive trees (all Marsh strain), 2.8; Smooth Seedy strain, 48.7; the 5 least productive trees, 51.5; Rough Seedy strain, 52.2.

CONCLUSIONS. — The Marsh strain is superior to all the others in the quality and quantity of its produce, and is the strain which should be propagated. It is advisable to top-work and re-bud the other strains (especially the Rough, Bell and Unproductive ones) with wood from the best Marsh trees. By the continual use of bud wood from selected trees a new strain of improved Marsh has been isolated and has proved both practically and commercially stable. This work of improvement and selection, helped by the action of the California Grapefruit Club, is being continued and will certainly influence the spread of grapefruit growing in California.

38 - **Method of Cultivating Cereals Tested in Portugal.** — See No. 15 of this Review

39 - **Comparative Cultural Experiments with Aurora and Manitoba Wheats in Vaucluse, France** (1). — ZACHARWIKZ, in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 31, pp. 878-88. Paris, August, 14, 1918.

In 1918 the author made comparative tests with Aurora and Manitoba spring wheats in collaboration with M. F. RIFU, on the Anseillaud estate near Caranne, Vaucluse. Aurora wheat was sown over 7 104 sq. ft. and Manitoba over 4 036 sq. ft. The plots were side by side. The soil was calcareous silicious clay in which potatoes had just been grown; it had received no manure in 1918. In 1917 only stable manure had been given at the rate of 11.9 tons per acre. The soil had been prepared rather early, being ploughed to a depth of 6 in. during the winter and the cultivator passed over immediately before sowing. The seed was sown on the morning

(1) See R. Dec., 1918, No. 1349. (Ed.)

of April 4 at the rate of 22 lb. (or 133.8 lb. per acre) of Aurora wheat and 14 lb. (or 142.7 lb. per acre) of Manitoba.

The weather, which had been rather dry for three months, broke the next day, thus favouring germination which occurred on April 14 for Manitoba and April 15 for Aurora. Vegetation was normal till June 5, when Manitoba began earing, followed on the 6th. by Aurora. From this period Manitoba seemed to fall behind Aurora which turned darker green, and gradually grew some inches taller than Manitoba. Nevertheless, a few days before harvest the latter made up the lost start and both varieties were practically equal in height, i. e. 3.14 ft. On July 13 Aurora turned its final colour, whereas Manitoba remained green a few days longer so that the first could be harvested on the 17th, four days before the second, cut only on the 21st.

The yields in grain obtained were: - 1) Aurora, 335 lb. or 2 054.5 lb. per acre; 2) Manitoba, 205 lb., or 2 212.5 lb per acre.

In view of these excellent results the author asks whether it would not be advisable to plant less winter and more spring seed.

40 - The Revictualling in Flour of Upper Senegal and Niger with Timbuctoo Wheat.

- *L'Exposition française*, No 90 p. 35. Paris, April, 18, 1918. Reproduced in the *Bulletin de l'Office Colonial*, Year XI No 126, p. 311. M. lun (France), June, 1918.

As the revictualling in flour of the colonies in French West Africa had become more and more difficult, the Lieutenant-Governor of Upper Senegal and Niger, aided by his Agricultural Departments, took steps to increase the area under wheat in the Timbuctoo region. The results obtained were completely satisfactory. At present some 500 metric tons of wheat are available for the European population and the Agricultural Services of the colony are now awaiting mills bought in France so as to replace the food flours from Corbeil with those from Timbuctoo wheat.

Till recently Sudan wheats were thought to be hard wheats. In reality they are a very complex mixture in which the hard type predominates, but from which, by selection soft wheats can be obtained. One soft wheat, with a very light-colour (red pericarp), will give a good flour with a low bolting percentage.

41 - Cultural Tests of "Selected Wasa" Rye, in Sweden. LJUNG, W E, in *Svenska Utsädesörskunnens Fidskrift*, Year XXVIII, Pt. 2, pp 71-81. Malmö, 1918.

The new variety of rye, "selected Wasa", is derived from a plant 0570 of common Wasa isolated in 1901 and is distinguished from the mother variety by its shorter stems, greater tillering power and a greater uniformity of the ears and grains. In South Sweden and the most favoured regions "selected Wasa" rye is inferior to the Stjärn and Petkuser varieties as regards yield in grain. Thus, the following yields per acre were obtained at Svalöf as means of the 5-year period 1906-10: Stjärn, 4 250 lb.; Petkuser, 4 047 lb.; and selected Wasa, 3 651 lb. In Värmland and at Bjerka Saby, where the climatic conditions begin to be less favourable for the growth of rye, the "selected Wasa" variety takes first place, owing to its

greater resistance to cold and to its adaptability. Thus, at Bjerka Säby, the following mean yields of grain were obtained per acre, for the period 1911-1916: --- selected Wasa, 2 138 lb.; Stjärn, 2 120 lb.; and Petkuser, 1 938 lb.

Further to the north (in Norrland) the resistance of the new variety to the bitter climate is well shown. At Luleå the following yields of grain per acre were obtained, as average of the period 1912-1917: native Norrland rye, 2 086 lb.; common Wasa, 1 561 lb.; and selected Wasa, 1 355 lb.

As regards the other characters (weight per bushel, weight of 1000 grains; strength of straw, yield in straw), the author gives the results of comparative tests carried out at Svalöf between 1911-17 with the following varieties: common Wasa, Bretagner, Petkuser, Stjärn, Midsonmar, Prof. Heinrich, Schlanstedter, Ostgöta black rye ("Ostgöta Grårag"). These tests showed that: 1) in weight per bushel, the selected Wasa variety takes first place with a weight of 59 lb.; 2) in weight of 1000 grains, the new variety is inferior to Stjärn (30.8 gm.), to Prof. Heinrich (26.7 gm.), to Schlanstedter (28.6 gm.) and to Petkuser (31 gm.); 3) the strength of the straw is mediocre 6.1 (according to the empirical scale where 1 expresses a very feeble and 10 a very strong straw); except the Bretagner variety (4.8), all the other varieties, including the common Wasa variety, are superior to selected Wasa, with a maximum of 7.9 for the Prof. Heinrich variety; 4) the yield in straw, 5 605 lb. per acre, is higher than that of all the other varieties, save Bretagner (5 751 lb.).

CONCLUSION. - The growth of the "selected Wasa" variety can be recommended in Central Sweden, in the southern parts of Norrland and in the mountainous parts of Småland, where the Stjärn and Petkuser varieties, owing to their poor resistance to cold, cannot produce a good crop.

42 - "Milho Caboclo", a Good Variety of Brazilian Maize. — Chacaras e Quintais, Vol. XVIII, No 3, p. 212 São Paulo, September 15, 1918

The Brazilian maize known as "milho caboclo", imported into and acclimatised in the United States, where it is called "Brazilian Flour Corn" is noteworthy for its high yield (50.1 to 74.6 bus. per acre), its tillering power and the fact that it produces 2 or 3 ears per stalk that are from 8.6 to 11.8 in. long, very white and excellent for roasting. The grain, when milled like wheat, gives an excellent bread or biscuit flour.

43 - Cultural Experiments with *Arum italicum*, in Italy. — PANIANELLI, E., in the *Stazioni sperimentali agrarie italiane*, Vol. I, Pt 1-2, pp 69 82 + 1 table Modena, 1918

In Italy the name "gigaro" is given to 2 wild species of *Arum*: — *A. maculatum*, commoner in the north and with smaller rhizomes; *A. italicum*, much more common in Central and Southern Italy, of bigger growth and with larger rhizomes, therefore more important in case it should be utilised commercially. Under the most favourable conditions, a rhizome of the latter species can attain a maximum weight of 250 gm., with an average weight of 80 gm.

The author attempted to grow *Arum italicum* at the R. Vivaio di viti

americane » (Royal Nursery of American Vines) at Noto (Syracuse). Small rhizomes weighing 15 to 40 gm. each were sown in September at distances of 8 in. 16 in.; a year after a weight of rhizomes 15 times as great and 2 years after a weight 26 times as great were obtained. *Arum italicum* does well in all soils. The rhizomes contain up to 21 % of starch in the rest period (summer), during which most of the carbohydrates are present as starch. During growth the starch diminishes, being replaced by saccharose. The three-year-old rhizomes have the highest starch content. In laboratory tests the author obtained from rhizomes gathered during the rest period a yield of 18 % pure starch, 20 to 23 % of glucose and 10 % of alcohol. On a commercial scale, using the plant used for extracting potato starch and for distilling the must obtained from it, a yield of 20 % of starch or glucose and 11 % of ethyl alcohol respectively, all of the best quality would be obtained. The cultural test made by the author was most successful. However, before beginning to grow this plant, the enormous quantities of *Arum* growing wild, from the sea to the mountains in all Italy could be exploited.

44 - ***Sechium edule* as a Forage and Food Plant.** — *Lavoura e Criação*, Year III, No. 9, pp. 214-215 Rio de Janeiro, Sept. 1918 — *Characas e Quintais*, Vol. XVIII, No. 3, pp. 191-192 + 2 Figs. San Paulo, Sept. 1918.

The climbing perennial Cucurbitaceous plant *Sechium edule* is a native of Mexico, where it was known as "chayoth", but it has spread to the Antilles and throughout tropical America, where its name became very much changed: "chayote", "choyote", "chochote", whence the French name "chouchoute" and the English name "chow chow"; in Brazil the French name became "xuxú" which was finally changed to "maxuxo" and "machucho". About the middle of the last century *Sechium edule* was introduced in France and North Africa; every year Tunis and Algeria exported hundreds of tons of the fruit of this Cucurbitaceae to the London and Paris markets. The stems and leaves form good forage; the flowers are very melliferous; the crude or, better still, cooked fruits form an excellent food for pigs, dairy cows, oxen and horses; they can also be given to poultry, especially turkeys and ducks. The fibre is used for making hats, etc.

The parts that can be used for human consumption are: — the fruit, which weighs from 400-1 000 gm, the young shoots, which form a substitute for asparagus, the root which weighs 2 lb. and more and contains 20-25 % of starch.

The yields and returns recorded are enormous. In Algeria, Dr. TRABUT states that 48 580 fruits are obtained per hectare, representing a weight of 30 000 kg. and giving, at 50 fr. per 100 kg., with a net profit of 35 fr. per 100 kg., a net gain of 10 500 fr. per hectare, to which must be added the value of the roots and green parts (25 000 to 30 000 kg. per hectare). At Porto Rico the average outturn of fruits is 360 000 kg. per hectare; in New South Wales, 600 000 kg. The record is, however, held by Brazil, where each plant produces an enormous quantity of fruits. It is said that

the fruit from a single plant sufficed to feed a pig for 6 ½ months. As pig rearing has a great future in Brazil, the growth of *Sechium edule* as a starchy food for pigs will probably spread greatly.

45 - Our Knowledge of Textile Fibres. — MICHOTTE, F., in *La Revue de la Filature et du Tissage*, Year II, No 11, pp 215-219 and No 12, pp 271-275 Épinal, 1917

The author, a well known expert on textile fibres, shows in his note that there is practically nothing on textile fibres in scientific literature, whether French or foreign. With the exception of the "*Travail des Lins*" (Linen Working) by A. RENOARD and "*Les Textiles végétaux*" by H. LÉCOMTE, good, but out-of-date works, the publications on textile fibres either cannot be found or are subject to serious criticism. The author points out some of the very numerous and serious faults of these works.

There is a certain number of serious works on a few textile plants and their relative industries (*Le Maqucy*, by SEGURA; *Le Sisal*, by MARQUESS; *L'Agave*, by MICHOTTE; *The Sisal Fibre Industry in Queensland*, by A. J. BOYD; various publications by W. TRELASE on *Californian Agaves*; *Les Sansevières*, by MICHOTTE; *Le Raphia*, by DESLANDES; Vegetable Fibres, in the *Kew Bulletin*; various studies published in the *Annales du Musée Colonial de Marseille* and in the *Agriculture des Pays chauds*; a study on Manila hemp and Agaves in the Philippines, by A. W. TAYLOR), but, out of 700 genera, only 5 or 6 have been dealt with more or less exhaustively, while 20 or 30 others have been treated in detached, incomplete and scattered papers.

Only 5 or 6 paper-making plants have been studied in scientific literature, whilst the author counts, besides bamboo, papyrus, alfa, diss, sparta, spartum, banana, pineapple, the yuccas, and the palms, 63 interesting species of plants, several of which have varieties growing in natural stands and mostly producing paper similar to that of alfa. It may be said that paper-makers are unaware of 92 % of the materials that they might use

The author, wishing to remedy as far as is possible this state of affairs, has written a "*Traité scientifique et industriel des plantes textiles*" (Scientific and technical treatise on textile plants), now in course of publication, and which, owing to its importance (10 volumes of 600 to 1 000 pages) will give a complete study of all the known textile plants; it will show that very little information is available regarding many of these plants.

46 - Cambodian Cotton and French Spinning. — PRUD'HOMME, F., in *L'Agronomie coloniale, Bulletin mensuel du Jardin Colonial*, Year III, New Series, No 19, pp 13-17. Paris, July August, 1918.

The author (Director of the "Jardin Colonial") summarises the report of M. MARTIN DE FIACOURT on the "*Possibilités du Cambodge au point de vue cotonnier*" (The Possibilities of Cambodia for Cotton-Growing) which was written for the 1918 Congress of Colonial Agriculture (1).

He next states that, for all the researches presented by M. DE FIACOURT,

(1) Report summarised in *R*, Dec. 1918, No. 1355 (Ed)

the local agricultural administration has applied for the collaboration of the "Jardin Colonial" which has examined, in France, the samples sent annually by M. DE FLACOURT.

Without giving details about the numerous enquiries and expert examinations carried out since 1913 on Cambodian cotton, with the help of M. MARANDE (Vice-President of the Colonial Cotton Association), the author gives a summary of the results given by a commercial test of Cambodian cotton carried out in 1917 at Calvados at the request of the "Jardin Colonial" and M. MARANDE by the "Filature de la Martinique", a cotton factory, results that were not known to M. DE FLACOURT when he wrote his report.

To carry out the test use was made of 4 bales of cotton, of a total weight of 450 kg., sent to the "Jardin Colonial" by the High Residency of Cambodia to be sold in the interests of the Colony.

The sale was made at 172 $\frac{3}{8}$ francs per 50 kg., based on the quotation for that day (March 6, 1917) - 169 $\frac{7}{8}$ francs. The cotton was thus sold for 2.50 francs more than the current price, and thus reached practically the same terms at American Good Middling, "28-29 mm." representing the quality most sought after by French spinners.

The test made at the "Filature de la Martinique" factory enabled the following observations to be made:— Cotton very clean, strong silky, worked well in the machines in which it was used alone. The waste amounted to about 4%. After carding, drawing, and passage through the spinning frames, the cotton was placed in a machine turning out No. 20 thread (1). Its class number was found to be 19.30 and the strength tests on 100 metre skeins gave an average of 96 kg. on the dynamometer. The cotton usually employed by the "Filature de la Martinique" in general gives an average of 80 kg. for the same number.

These results are very satisfactory and justify the comparison to "Good Middling American 28 29 mm." made at the moment of sale.

47 - **Cotton Growing Tests in Spain.** — CRIMADES Y MARINER ENRIQUE, in the *Boletín de la Asociación Económica*, Year X, No. 116, pp. 676-689 Madrid, August, 1918.

The present world's production of cotton is about 21 million bales of about 250 kg., i. e., 5 million metric tons in round figures. At the sale price of about 1.60 francs the kg., this represents a world value of from 7 500 to 8 000 million francs. Soon after 1840 the world's consumption of cotton began to increase annually by 3% and it is calculated that it may attain 42 million bales.

The production as a percentage and in millions of bales is distributed as follows: — North America, 65.5%; 13 to 14 — India, 18.5%; 3.5 to 4 — Egypt, 6.5%; 1.33 — other countries, 9.5%; 1.94. The European production amounts to 28 000 bales, furnished by Bulgaria, Turkey, Crete, Greece and Italy. The European consumption is 9 $\frac{1}{2}$ million bales, while the amount produced in Europe is hardly 2.7% of that consumed. Spain

(1) Thread of which 20 000 metres weigh 100 gm. (Author).

consumes (rough average for 1913-15) 104 000 metric tons of unginned cotton. Russia produces, in Turkestan, from 700 000 to 800 000 bales, i. e., about double the amount consumed in Spain and that at a latitude higher than Southern Spain and in a steppe region.

In Spain, cotton was grown in the Seville region after 200 A. D. From the 10th to the 15th century the production increased greatly and manufacturies were founded at Seville, Cordova and Granada. In the 18th century the production of cotton began to decline (even though, in the 19th century, the mills in Catalonia still exported cotton goods to Italy, France and England) and ended by stopping completely after the discovery made in the United States in 1825 of the ginning machine which rendered competition impossible by reducing to 0.76 *d* the cost of work which, when done by hand, could not be done for less than 2 s 4 ¹/₂ *d* by women.

The OSMA law was passed on July 19, 1904, in order to revive cotton-growing in Spain. This law awarded bounties to cotton producers and exempted cotton plantations from taxes for 3 years. The Jerez de la Frontera experimental farm ("granja") successfully carried out some cotton cultivation tests which, however, did not decide the farmers to take up the crop. In 1912 the author began his cotton cultivation tests (with Upland or American; Motril; Jumel, an Egyptian variety) on the San Pedro de Alcántara farm (province of Malaga) with seed produced by the experimental farm. The outturn per hectare of Upland cotton was: - in 1912, 524 kg. of ginned cotton and 1 134 kg. of seed; in 1913, 757 kg. of ginned cotton and 1 690 kg. of seed; in 1914, 607 kg. of ginned cotton. The Jumel variety, which always gave bigger crops than Upland cotton, was grown also in 1914. Excluding the year 1917-18, on account of the exceptional prices reached by cotton, when a revenue of 1 500 francs per hectare was obtained, Upland cotton yielded an average, from 1912-1916, of 1 387 francs as the value of the product per hectare, the cost of production per hectare being 873 francs, thus giving an income of 514 francs. From 1914-16 Jumel cotton gave an average production per hectare worth 1 492.72 francs, at a cost of 846.08 francs; the revenue was 646 64 francs. Even under normal market conditions it can be assumed that Upland cotton, will give a yield of 586 kg. of ginned cotton at a sale price of 1.70 francs per kg., with a cost of production at 1.23 francs per kg., when the revenue will be 275.42 francs per hectare. For Jumel cotton, which is more appreciated as the staple is very long (41-42 mm.), it may be assumed that the yield will be 520 kg., the sale price 2 francs and the cost of production 1.39 francs i. e., the revenue will be 323.83 francs per hectare.

In Spain, cotton can be grown throughout the low parts of the valley of the Guadalquivir and in the coastal zone up to Almeria, up to Alicante and even up to Valencia and Castellón with however, a higher cost of production. According to the author, cotton in these districts should be irrigated 8 times a year, with a total height of 60 cm. of water.

The slightly saline soils of the two coasts are admirably suited to the cotton-plant. By crossing the Upland and Jumel varieties the author has obtained a variety that combines the qualities of the two parents.

48 - **A Catalan Society for the Development of Cotton-Growing in Spain.** - *El Progreso Agrícola y Pecuário*, Year XXIV, No. 1050, p. 191, Madrid, 1918.

At Barcelona the "*Asociación Catalana para el fomento agrícola algodonero*" has been formed with the object of developing cotton growing in Spain and her colonies, by all suitable means, such as :

a) Publishing treatises, reviews, articles from periodicals, pamphlets, etc., disseminating data, advice, instructions, statistics, technical and economic works in order to introduce, propagate and encourage that crop.

b) Getting into touch with farmers either directly or through intermediary organisations to provide them with technical information, seeds, and everything that might help to attain the desired end.

c) Intervening in the contracts that guarantee that the growers can sell their products at a remunerative price by helping them with the harvest and by introducing related side-industries to enable them to make the best out of these products.

d) Installing experimental or demonstration plots and everything that will encourage the growing of the crop and educate the farmers in this subject.

49 **The Edible Banana Tree as a Textile Plant, in Spain.** - See No. 117 of this Review

50 - **The Olona (*Touchardia latifolia*), a Hawaiian Textile Plant.** - MAC CAGKEY, V. (College of Hawaii, Honolulu), in *Science*, New Series, Vol. XLVIII, No. 1236 Lancaster, Pa., September 6, 1918

The olona (*Touchardia latifolia*) grows only in Hawaii and supplies a textile fibre generally considered to be the strongest and most durable known. The author describes the taxonomical characters of the olona. It is called *latifolia* on account of its large, broad petiolate leaves which are 9 to 16 inches long by 5 to 10 inches broad. As is the case with many rain-forest plants the flowering period is very variable. The olona belongs to the hygrophytic group of the Hawaiian flora so common in the mountain forests. It is never found in the plains and occurs only in patches. Reproduction is not vegetative. The native method of cultivation was most simple. Olona patches were cleared of all obstructive vegetation without touching the trees, the shade of which is necessary to the plant. Situations near a water-course were found, the bark left to macerate partially for several days in the running water and the remaining pulp then removed by scraping. The fibre was used for numerous purposes, especially for fishing lines and nets on account of its great resistance to salt water.

The chief qualities of the fibre are :

1) Its great tensile strength 8 times greater than that of hemp (*Cannabis sativa*),

2) its great resistance to salt water; a fish line made of olona in use for over 50 years was found by the author to be in excellent condition;

3) its pliability and, consequently, its suitability for spinning by hand.

The author recommends the use of this fibre. To grow it methodically the plant, now wild, must be transformed into a cultural form.

It will then be possible to put on the market a new fibre with a greater tensile strength, weight for weight, than any other known fibre.

51 - **The Production of Copra in the Federated Malay States and South Pacific Islands.** — I. Federated Malay States, The Production of Copra *The Board of Trade Journal*, Vol. CI, No. 1141, p. 467. London, 1918. — II. South Pacific Islands, Review of Copra Export Trade *Ibid* (1)

I. — The Director of Agriculture, Federated Malay States in his annual report states that shipping difficulties caused the local price of copra to remain very low throughout 1917, and both estates and small holdings have suffered considerably. One result has been that a large number of coconut trees, particularly in the state of Perak, have been cut out and an Enactment had to be passed to prevent a recurrence of this, except under special conditions.

The following statement shows the amount and value of copra exported from the Federated Malay States in 1916 and 1917.

	1916	1916	1917
	Tons	£	£
Perak	11 849	201 330	219 145
Selangor	2 725	41 649	60 102
Negri Sembilan	57	881	1 262
Pahang	192	3 000	5 753
Total	14 823	249 869	292 265

These figures include exports to the Straits Settlements and do not indicate the amount actually exported from the whole of the Malay Peninsula. Upon reference to the summary of the foreign imports and exports of the Straits Settlements and British Malaya for 1917, it is found that the total export of copra last year from the Malay Peninsula is given at 77 000 tons against 73 236 tons in the previous year; but whereas the value of the 1916 exports is returned at £1 407 300, the value of the larger export in 1917 is given as £90 314. The export of coconut oil in 1917 amounted to 15 787 tons, valued at £209 896, against 7 891 tons in 1916, valued at £285 375.

II. — Copra is the staple article of export of the Pacific Islands, and its product - coconut oil - ranks amongst the most favoured of the vegetable oils now in use for edible purposes. The proportion of production of the South Seas is at present about 14.47 % of the total world production (2). But the possibilities of further production are stated by the Australian Inter-State Commission to be immense.

Although the potential wealth of the South Pacific Islands may be said to be as yet practically unexploited, the present output of copra will be largely increased from areas already planted, the trees on which have not

(1) See R. 1915, No 135 (Ed)

(2) For the world production of copra see the Annual Reviews INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL INTELLIGENCE: *The International Trade in Feeding Stuffs*, Rome.

yet come into bearing. Precise information in this regard, however, is not obtainable, but it is considered probable the present output of about 71 000 metric tons per annum will be doubled when the trees at present under cultivation are in full bearing.

The following table shows the exportations in 1912 of copra from the South Pacific Islands, indicating at the same time the islands of export :

Exports of Copra from the South Pacific Islands.

	<u>Tons</u>	<u>£</u>
<i>British</i>		
Fiji	13 710	242 073
Solomons	4 196	73 637
Gilbert and Ellice Islands,	3 500	35 000
Tonga (Friendly Islands)	11 120	209 567
Cook and other Islands	2 133	40 549
<i>Total . . .</i>	<i>34 659</i>	<i>600 826</i>
<i>Others</i>		
New Caledonia and Dependencies	2 810	67 932
Society Islands (Tahiti) and other French Islands	5 886	112 569
Samoa (American) (*)	—	—
Samoa (German)	11 201	103 496
<i>Total (*) . . .</i>	<i>—</i>	<i>—</i>
<i>New Guinea</i>		
British (Papua)	993	19 368
German	17 227	344 540
<i>Total . . .</i>	<i>18 220</i>	<i>363 908</i>
New Hebrides (**)	5 000	160 908

(*) Not available (**) Estimate

The average exports of copra of the South Pacific may be stated also to be from 70 000 to 80 000 tons.

52 - **Culture and Fertilisation as Affecting the Oil Content of Peanuts.** — SHAYAN, H S, in *The Philippine Agriculturist and Forester*, Vol VI, Nos. 2-3, pp. 84-93 + Bibliography of 18 Works. Los Baños, 1917

Experiments on the manuring of 6 standard varieties of peanuts, with stable manure, wood ash and a mixture of ash and manure, together with a series of determinations of the soil content of each variety under different treatments.

Fertilisation with ash, manure and ash, or manure alone, increased the oil content ; the ash in a majority of the cases gave the highest increase followed by the mixed fertiliser and the manure in the order named. The variation of the oil content due to different conditions for any one variety is as wide as varietal differences.

The comparative oil content of the different varieties is as follows :— Kinorales, 57.40 %; Big Japan, 48.75 %; American, 47.75 %; Montalban (Chinese) 51.42 %; Native Lemery, 49.93 %.

Fertilisation increased the actual yield of marketable pods. Ridge cultivation gave lower results for yield and oil content than flat cultivation.

The Kinorales, which corresponds to the early Spanish variety, although a low yielder, possesses desirable characteristics that make it preferable for oil purposes :— 1) quicker maturity; 2) high oil content; 3) ease of harvesting; 4) erect habit of growth.

53 - Composition of Indo-Chinese Castor Oil. — PRUDHOMME, F. in *L'Agronomie coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year III, No. 19, pp. 25-27. Paris, July-August, 1918

The immense growth of aviation since 1914 has given considerable importance to the question of the provision of castor oil, used for lubricating aeroplane engines. The "Jardin Colonial" has made an inquiry as to whether it is possible for France to obtain the enormous quantity of castor oil she requires from her over-seas possessions.

Some hundreds of analyses made at the "Jardin Colonial" by MM. P. AMMANN and I. RIGOTARD have shown that, throughout the French colonies, there are castor oil plants which, as regards oil content, are comparable with and even superior to the varieties commonly imported into Europe and known commercially as Coromandel Castor Oil and Bombay Castor Oil.

Amongst the samples examined those of Indo-Chinese origin, which are said to be fair representatives of the type usually obtained by the natives, deserve special attention, as it seems possible that an appreciable amount of the castor oil required by France (1) can be obtained from Indo-China.

A table given in the author's note shows the composition of castor oils from Indo-China and India. It is shown that the oil content of the raw seed varies from 49.4 to 50.6 % for the former and 42.20 to 52.3 % for the latter. The analytical data given in the table show that if the oil content of the Indo-Chinese castor-oil plants seems lower than that of certain castor plants of North America, which yield as much as 54.6 %, of oil, they are mostly slightly richer in oil than those of India.

There will probably be no need for Indo-China to import the seeds required for developing the cultivation of the castor oil plant.

54 - New Oil Seeds from Sierra Leone. — See No. 8 of this Review

55 - Vegetable Dye-Staffs. See No. 8 of this Review

56 - Grafting of Hevea in Java. — See No. 68 of this Review

57 - Study on the Production of Sugar Beet Seeds. — See No. 9 of this Review

(1) See R., Nov. 1918, No. 1188 (Ed.)

- 58 - **The Care of Coffee Plants Damaged by Frosts, in Brazil.** — *Chacaras e Quintas*, Vol. XVIII, No. 2, p. 120 São Paulo, August 15, 1918

The results of experiments made by the Agronomic Institute of the State of São Paulo (Brazil) on the renewal of old coffee plantations and rational pruning can be applied as is advised by the Institute, to coffee plantations "burnt" by frost.

The affected plants should be pruned, but only at a later period, when they have budded, so as to retain as much as possible of the unaffected parts. Coffee produces chiefly on the wood produced this year or at the end of the previous year. It is, therefore, useless to prune old, large branches and only the young branches that have been most "burnt" should be dealt with. If these are quickly and suitably pruned it will cause the production of new buds, while unpruned branches, even if undamaged, grow and only produce a little fruit at the tip.

Pruning should be accompanied by manuring (ashes, blood meal, bone meal, cake, fertilisers). The coffee plant requires shallow cultivation, hoeings, and shallow trenches for draining off the water and circular trenches round the trees should be made.

- 59 - **Coffee and Tea of Uganda.** — See No. 8 of this Review

- 60 - **Plants Yielding Essential Oils of the Seychelles** — See No. 8 of this Review.

- 61 - **Tobacco-Growing in Indo-China.** — *Congrès d'Agriculture coloniale*, Gouvernement général de l'Indo-Chine, Saigon Series, Bulletin No. 6, 11 pp. Saigon, 1918

M. A. CHEVALIER (Chief of the Mission for the Inspection of Indo-Chinese Agriculture and Forests) calls attention to the fact that the development of tobacco-growing in Indo-China is a very important task. This crop is grown by the natives on a fairly large scale in certain regions of Cochin-China, Annam and Tonkin, but the production does not suffice for local needs. In addition, it is a family crop, each grower only utilises a very limited area. The amount of leaves gathered at a given moment by each grower is small, and insufficient to allow them to be suitably fermented to do which considerable quantities of leaves gathered at the same time should be piled in heaps. The native pays little attention to the preparation of the tobacco by European methods. The treatment he gives it after gathering the leaves is very primitive, at any rate tobacco thus prepared suits the taste of the consumer (whether Annamite or not) and the local production does not satisfy the demand.

Besides local tobacco consumed by the native, about 1000 metric tons of tobacco worth 4,300,000 francs have to be imported annually from other countries or France. It would be excellent if these tobaccos were produced on the spot and if a part of the varieties required were supplied to France, which, before the war imported tobacco worth more than 40 million francs a year from foreign countries. This result could only be attained by applying the methods that have shown their worth at Deli, Java, Manila and Cuba to the growth and preparation of tobacco in the tropics. Only big enterprises with a large capital are capable of introducing these methods into

the French colonies and they would have to work over large areas. In Sumatra land that has grown tobacco one year has to remain fallow for the next 8 or 10 years before the same crop can be grown again.

Struck with the need for up-to-date methods, MM. A. R. and L. FONTAINE, who have already obtained such interesting results by the application of the latest scientific methods to the production of alcohol from rice in Indo-China, also wished to apply the most perfect technical data to the cultivation and preparation of tobacco. In 1913 they, founded the "Manufacture des Tabacs de l'Indochine" Company, and to provide the raw material they started a large plantation in Central Tonkin, on the Kim-Xuyen estate, and sent for experts from Sumatra to organise it. This was the right method to follow. Although only begun in 1914 their tests have already begun to give most encouraging results. The director of this plantation has prepared the work, summarised below, regarding the methods for tobacco growing and preparation in use at Kim Xuyen.

Tobacco is grown in nearly all the provinces, especially in the Thai-binh and Hai-duong provinces in Tonkin, in South Annam, and in the Govap and Hocmon regions in Cochinchina. The natives prepare it with primitive methods and the products are absolutely different from those made in France and not at all suited to European taste.

The "Manufacture des Tabacs de l'Indochine" Company has already obtained very interesting results. The soil is prepared by clearing away the trees and uprooting the stumps. This should only be done partially on the hillocks intended to carry tobacco for one year only, in order to facilitate reafforestation. On the contrary, however, it should be complete for land definitely reserved for tobacco, as well as on hillocks on which coffee will be planted. After this, the ground should be dug up and finally a turn with a heavy rake should be given the day before planting out.

The following subjects are considered: - sowing and transplanting, earthing-up (3 times), clearing of caterpillars, thinning-out (which is continuous; in very fertile soil a shoot providing 6 to 8 medium leaves is left), gathering and threading (done simultaneously), drying (requiring from 20-40 days, according to the variety and the weather conditions), fermentation (in mounds of from 1 to 20 metric tons), sorting (in four qualities for "cutting", according to the shades light tawny, dark tawny, light brown, etc.), baling (bales of about 70 kg.).

Many varieties are grown, including Comstock, Hongrie, Manille, Maryland, Java, Deli-Sumatra, etc.

Besides direct cultivation the crop has been undertaken on the "metayage" system on the farms in order to accustom the natives to the method used for tobacco growing in other countries. The results obtained are becoming more and more satisfactory, as the native labourers engaged in the direct cultivation or "metayage" become more familiar with the special rational methods for growing the different varieties of tobacco.

The yields vary according to the variety. They are quite satisfactory if they are compared with the figures obtained on the oldest exotic plantations.

These tobaccos burn well. Certain varieties burn with a surprising ease. The colour, "suppleness" and aroma leave nothing to be desired.

After one or two years of tobacco, coffee plants (*Coffea arabica*, *liberica*, Chari, *robusta*, Bourbon) are planted on the hillocks in the estates. Tobacco has sometimes been planted a second time between the rows of coffee, without the latter suffering in any way. This combination enormously reduces the cost of installation and up-keep of the coffee plant.

Shade trees are planted to protect the coffee plants. To avoid the erosion of the hillocks, the Javanese system of "roraks" — little horizontal ditches that receive the soil washed down by the torrential rains and stop the water allowing it to soak gradually into the soil — has been adopted, with convincing results. At the end of 1917, 50 000 coffee plants were planted.

On the estates of the "Manufacture" Company several thousand plants of Annamite and Assam tea are grown, which will be used for modern preparation tests.

There are about 300 head of live stock, mostly of the Annamite breed.

The manure is applied to the coffee only; mineral and vegetable manures are used for the tobacco; castor oil cake, ground nut cake and other prepared manures give excellent results.

The development of the varieties that could be treated by the works of the French Estate monopoly might be a considerable source of wealth for Indo-China. The foundation of Experiment Stations like those of Buitenzorg (Java) and Medan-Deli (Sumatra) is indispensable.

Besides selling to the French State monopoly Indo-Chinese growers can certainly find a buyer much closer to them and sell a large part of their good quality tobaccos to the Hanoi manufactory, which could soon, by laying down modern machinery, vie favourably with the most important establishments in France and other countries.

62 - **Tobacco Nurseries in the Dutch East Indies** (1). — I YENSEN, H., Considerations on Tobacco Nurseries, in the *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXXIII, pp. 41-55 + 1 Fig. Semarang, 1918 — II RIJZEN, G. I., New Method for Thinning-out Tobacco Nurseries, *Ibid.* p. 37 + 1 Fig.

I. — The grower should try to obtain strong, resistant tobacco plants by providing them with abundant food, water and sun. The nurseries should be suitably manured by spreading soil as evenly as possible and mixing a certain amount of sand or compost; no "Dessah manure" (native village) should, however, be mixed with it, as it might introduce *Phytophthora*.

Instead of watering the plants the water they require should be run around the lands (ridges). The soil must be moistened in an intermittent manner, so that it shall not remain water-logged. The nurseries must be exposed to the light, and from the beginning the young plants should be accustomed to the heat of the sun.

The nurseries are protected against heavy rains by artificial shelters. The plants should only be transplanted when they are about 46 cm.

(1) See R, May, 1917, No. 446 (Ed.)

high, as is done by planters in Deli. The shade leaves should be suppressed.

II. — The thinning-out of a tobacco nursery so as to leave the plants spaced at 5 cm. distance — as is now done in most plantations — is a fairly difficult task for a coolie. To avoid this difficulty the author suggests the following practical method: by means of string, the seed bed is divided into 10 equal divisions on its length and 4 on its breadth, so as to have 40 equal plots. All the coolie has to do is to leave 25 plants in each plot, so that there would be $40 \times 25 = 1000$ plants on each land, which gives sufficient material for transplanting.

63 — **Reports on Tobacco Fermentation Experiments Made in the Dutch East Indies, in 1916.** — SIDENIUS, E., in the *Mededeelingen van het Proefstation voor Vorstenlandsche Tabak*, No. XXXI, pp. 15-57 + Fig. Samarang, 1917

The series of tobacco fermentation experiments carried out for several years by the Vorstenlanden Tobacco Experiment Station has led to the construction of a building where the mounds of tobacco can undergo continuous fermentation without further handling.

Satisfactory results were obtained. The tobacco fermented is of very good quality. The building is composed of 3 rooms 4 metres wide, 4.75 metres long and 3.50 metres high internal measurements. The double walls are hollow, but closed here and there by brickwork which supports the walls. The middle walls, which are very thick, isolate the rooms sufficiently from one another. Lighting is obtained through 3 small windows 25×50 cm.

As the temperature is lower near the windows, it is taken in the centre of the room by means of electric thermometers. The rooms are closed by double doors, the outer one of wood, the inner one of eternite. The rooms are roofed by slabs of eternite, above which there is an insulating layer of rice husks covered by planks, the ceiling is supported by wooden supports.

Gas pipes, 5 cm. in diameter, are used for heating. In each room there are 3 rings of tubes running along the walls, provided with a tap for regulating the temperature and arranged in such a way that their lower end is near the wall of the machinery room. At that point there are also drainage pipes provided with taps, so that the water of condensation can be drained away to the outside. In fact, the water must be drained off regularly or the pipes will not heat. Tubes, 25 mm. in diameter, connect the heating pipes to the boiler. The steam is produced by a locomotive boiler placed outside together with the engine that drives the suction pump.

The pressure is generally maintained at 2 atmospheres; it is rare that a heavier pressure is required to maintain the desired temperature.

In order to maintain a suitable degree of humidity in the rooms, a ring of 25 mm. pipes, perforated with holes about 1 mm. in diameter, is placed on the floor; the ring is connected to the steam supply. This simple device enables the degree of humidity to be regulated exactly, while it is controlled by means of 2 electric thermometers acting as hygrometers. The floor is slightly sloping, so that the water of condensation can flow away.

The tobacco is heaped up on the flooring, which is raised to prevent it decaying and to allow the steam to escape through the holes in the ring (described above), placed just below the centre of the heap. A long iron pipe, open above and perforated along its length is introduced vertically into the heap. The air passes along this tube into the centre of the heap. The air is lead from the vertical tube to the perforated rings used to ventilate the outer part of the heap. As the heap subsides here and there as it ferments, the rings move in a vertical direction and should, of course, be joined to the central tube in such a way that they can move.

Ordinary rubber tubes should be used to join the central pipe and the rings rather than the flexible metal tubes used in previous experiments.

- 64 - **Acclimatisation of Cinchona in Brazil.** — DE MORAES, P, in *Chacaras e Quininas*, Vol XVIII, No 3, pp 181-183 São Paulo, September 15, 1918.

The idea of acclimatising cinchona to Brazil is not new; it has been tried several times, but was afterwards abandoned. In 1868, Señor J. DIAS planted at a place near to Theresopolis (San Paulo), seeds of *Cinchona Calisaya* (the species richest in quinine: up to 80 %) which had been sent to him from the Pacific zone of South America. In his plantation there are now more than 100 000 plants left in a completely neglected state, so that their bark hardly contains 5 % of quinine. *C. succirubra* had been sown in the same locality and did very well. The author suggests that cinchona should be sown or planted, with material from Java, in the mountainous parts of Brazil.

- 65 - **Wax-yielding Plants of Mexico.** — RAMÍREZ ROMÁN, in *La Revista Agrícola, Órgano oficial de la Dirección de Agricultura y Fomento, México*, Vol II, No 6, pp 257-259 + 2 Figs. Mexico, May 15, 1918.

A botanical description (without identifying the species) of 5 different species of plants furnishing the wax called "candelilla", used for making phonograph records, boot grease, furniture polish, etc.

Two of the plants examined belong to the genus *Pedilanthus*, section *Calceolastrum*, and one to the genus *Euphorbia*.

- 66 **Utilisation of *Asphodelus ramosus* in Italy.** See No 108 of this Review

- 67 - **New Method for using Explosives (1) in Planting Trees and its Advantageous Use in the Rapid Reconstitution of Orchards in Devastated Regions.** — PIÉDALLU, A, in the *Comptes rendus de l'Académie des Sciences*, Vol CLXVII, No 21, pp 763-764 Paris, November 18, 1918

The author has noticed that wild plants grow with rare vigour on the edges of old shell holes or old trenches destroyed by explosives. This vigour is probably due to the cracking of the soil and its impregnation by nitrogen compounds. This remark recalls the experiments made in the Western United States on planting 2-year old cherry trees in holes blasted out by dynamite. The cherry trees planted in this way reached a height

(1) See R, 1911, Nos 2529 and 3135; R 1912, Nos 671, 777 and 1398; R, 1913, No 230; R, 1914, No 1092. (Ed)

of 10 feet, while the same trees planted with a spade remained weakly, barely reaching 5 feet in height.

The author has attempted to apply these observations, and experiments practically with the collaboration of M. MALHOUË.

They have found out the composition of an explosive that resists shock and damp, which can be moulded, is quite free from chlorine, is very powerful in small volume and only explodes under the action of a fulminate primer. This forms a cartridge to which is added a bottom of fertilisers, varying according to the soil: - phosphates, nitrates, potash, etc. The cartridge is formed of a celluloid tube, in strong paper or cardboard, serving as an envelope and ending in a cone or closed by a stopper of the same form. The compressed fertiliser is placed in the bottom of the tube round some explosive, then comes the cylinder of explosive in which there is a hole to receive the fulminate primer. The whole is closed by a cork pierced with a hole, through which passes, in a somewhat tight fit, the bickford match attached to the primer. The explosive and the accessory bottom are paraffined on the outside.

To use the cartridge, a 60 cm. hole is made with an iron rod or other tools. In suitable soil the hole is made with a wooden cone of a diameter slightly greater than that of the cartridge, down to a depth of 60 cm., the cartridge is inserted, the match lit, when those present retire to cover.

The explosion produces a spheroidal cavity nearly 80 cm. deep, with deeply cracked walls. The soil is left to absorb the vapours given off by the explosion and all that remains to be done then is to plant the tree and beat down the soil round the roots. Under these conditions the tree finds all the elements necessary for its growth finely powdered and intimately mixed with the soil, so that it cannot but grow vigorously and fruit in the shortest possible time. This method would be specially useful in compact soils where the ordinary methods of planting leave solid walls which the rootlets are unable to penetrate.

This process can be used for all kinds of tree planting, even in the colonies, as less labour is required and growth is favoured.

68 - **Shield-grafting Rubber and Cacao Trees in Java.** — I VAN HELDEN, W. M., Shield-grafting Rubber Trees, in *Mededeelingen uit den Cultuurtuin*, No. 9, Buitenzorg, 1918 - II STUUR, E. H., Shield-grafting Cacao Trees, *Ibid.*, No. 10, pp. 15-23.

In the Experiment Garden at Buitenzorg, Java, has been undertaken a series of experiments to determine the best method of vegetative multiplication of the hevea and cacao trees. The results of the experiments in shield grafting (the method preferred) are given in the two papers under review. The three following methods of grafting were tested: 1) FOLKERT'S, or shield grafting; 2) \perp grafting; 3) veneer grafting.

The best results were obtained with FOLKERT'S method. The operation is more rapid as the piece of bark bearing the bud does not need to be equal in size to that taken from the stock. After joining, the eye develops more quickly, and, moreover, the joining is more complete. The \perp graft also gives good results, but is less simple than the previous method. Veneer

grafting is less satisfactory as joining is very slow and many scions gradually die. The operation is also longer than the preceding two. The chief condition for successful grafting is strong stock. The buds must be taken from strong and not too young branches. In hevea the scion must be inserted as low as possible as it must later form the cupping surface. Shield grafting causes a smaller flow of latex than the other two methods. Joining is complete at the end of about 4 weeks and the stock may then be topped about 5 inches above the graft.

69 - **Cultivation of Balsa Timber in Costa Rica.** — McMILLAN, E., in *Commerce Reports*, No 117, pp 669-671 Washington, D C, 1918

"Balsa" (1), the lightest wood known, is now much in demand where lightness of construction is of importance, and as it is very porous, it acts as a good insulator and is thus used in insulation against heat and cold. Another valued characteristic of this wood is that it offers the minimum amount of air resistance, and its usefulness in aeroplane construction is therefore apparent.

Though the "Balsa" tree grows best in rich ground, it will thrive on almost any ground in the tropics except swamp, but it is a second growth tree, being found only where the ground has once been cleared. The trunks of the trees are smooth and mottled white and gray. No parasites seem to grow on them, as the boles are perfectly free of vegetation. The leaves of the young trees are very thin and large often 12 or 14 inches across, and grow on long stems of 18 inches or more. The trees grow separately in groups of male and female, the male being known as "Burrillo" and the female as "Balsa Real". The latter only is now marketable, as the male tree contains too much wood fibre. Both groups are very similar in appearance except at flowering time.

The "Balsa Real" tree blossoms about the third year, in midsummer. From long green pods of 6 in. or more light pink blossoms emerge. Later the pods shrink to about 1 in. in thickness, or half their former dimensions, and about two months after the appearance of the blossom the hitherto erect pod bends and breaks into six sections which open and reveal quantities of golden-brown cotton that the natives use for pillows and mattresses, often cutting down trees at seed time for this purpose. The seeds cling to the cotton in rows along the sections, about 400 seeds to the pod. These seeds are about the size of a pinhead, 22 500 of them being required to make a pound.

Small vines are the worst enemy of young "Balsa", as the young trees are soft and very sensitive. When the sapling is about 3 in. out of the ground all surrounding weeds should be cleared away. In one year the trees sometimes grow to 10 ft. in height and 4 in. in diameter and to a height of 20 ft. in 2 years. Until they reach this development the trees contain

(1) Corkwood = *Ochroma Luuopus*, Sw (Ed

too much vegetable matter to be fit for use. A diameter of 10 in. is acquired in 5 or 6 years. A 5-year-old tree should produce at least 200 board feet, worth about \$8 at current prices. Dimensions of logs for market are now 8 to 30 in. in diameter and from 8 to 16 ft. long.

There is a white Balsa and a red Balsa, or "Balsa Colorado" as it is called. The white, "Balsa Blanca", and the red are alike in the flowering season and in general appearance; and in standing timber the difference is hardly apparent, but when cut the dark of the "Balsa Colorado" has a deep red tinge, from which it derives its name. It requires twice as long to dry, and even when dry it is twice as heavy as "Balsa Blanca", having more sap and more wood fibre. Some of the logs have a dark, reddish core, which contains enough sap or moisture to cause decomposition and render them worthless. Logs cut from the lower part of the tree next the root contain a great deal more water than the upper part, but when thoroughly dry are almost as light and should be just as useful as the rest. When the white wood, or "Balsa Blanca", ages it reddens, colouring from the bottom upward, and at the same time the bark roughens. Trees 8 or 10-years old are often too heavy for market. "Balsa" logs deteriorate very quickly after felling if exposed to the weather, and borers attack them if they become dry. The logs cannot be cut more than a week or 10 days in advance of shipping.

The future of the Balsa Trade in Costa Rica depends very largely on whether or not it can be successfully grown by planting on land prepared for the purpose and there are indications that it can be.

Planting can be done 12 by 12 in. apart and if later this is found too thick the weaker plants can be pulled up. While the rainfall is sufficient for planting thus thickly it takes considerably longer for the tree to reach marketable size, but when mature it is much taller and freer of branches, besides yielding a larger number of logs. It will take about 8 years for trees planted in this order to reach marketable size and they will then yield logs about 12 by 14 in. in diameter and 28 to 30 ft. long. The Guacimo tract should therefore produce 100 trees per acre with 200 board feet of good log, or 20 000 board feet per acre. The cost of straight planting, including cleaning and preparing the land, lining, circling, and planting (using small plants set out to a stake), and three windrowings to complete cultivation for first year, should not cost more than \$10 per acre, as follows:—Cleaning and preparing land, \$3; circling, lining, and planting, \$2; circling and windrowings, \$3; 10% supplying at \$0.01, \$0.10; overhead and miscellaneous \$1.90. After a period of 14 months from time of planting no expenses for cultivating are entailed.

Another and a cheaper method of planting Balsa is to clean and burn the land and scatter seeds where necessary. The work can best be done from January to March; during the remainder of the year it is difficult to burn owing to the constant rains. By this method a grove should be established for a maximum expenditure of \$4 per acre. After a year no further work is required.

70 - **Some Chilean Woods Suitable for Making Cellulose.** — *Boletín de la Sociedad de Fomento*. Year XXXV, No. 6, pp. 378-382. Santiago de Chile, June, 1918.

At the request of the Chilean Government, the Laboratory for the study of woods at Madison (Wisconsin, U. S. A.) has carried out cellulose and paper making tests with the 6 following species: "olivillo", "laurel", "coigüe", "lingue", "roble", and "quila" (1),

The caustic soda treatment was used. The average, maximum, and minimum fibre lengths (in mm.) found were: — "olivillo": 2.15, 2.62, 1.34; "laurel": 1.31, 1.60, 1.90; coigüe: 0.86, 1.02, 0.70; "lingue": 1.11, 1.60, 0.61; "roble": 1.45, 1.76, 1.12; "quila": 2.20, 2.66, 1.34.

It was found that olivillo is suitable for making naturally coloured packing paper; coigüe and lingue are suitable for making bleached paper pulp for books and similar articles; quila gives a pulp which, unbleached, makes paper for journals and packing; when bleached it can be used for making writing paper, books, etc. Laurel and roble, as their fibres are too short and they do not bleach readily, are unsuitable for making cellulose.

71 - **Forestry in Burmah.** — See No. 1 of this Review.

LIVE STOCK AND BREEDING.

72 **Contributions to the Knowledge of Brazilian Oestrinae.** LUTZ, A., in *Memorias do Instituto Oswaldo Cruz*, Vol. IX, No. 1, pp. 91-112 + 3 Plates, Rio de Janeiro, 1917; Abstract in *The Review of Applied Entomology*, Vol. VI, Ser. B, Pt. 7, pp. 209-130 London July, 1918.

The author prefaces these notes by stating his agreement with the view that the *Oestrinae* should be treated as a sub-family of the *Muscidae*.

A key is given to the genera observed in Brazil together with the following list of South American species. From French Guiana, *Cuterebra ephippium*, Latr.; from Patagonia *C. patagona* Guér.; from South America, *C. megastoma* Brauer.; from Trinidad, *C. funebris* Aust.; from Argentina and Brazil, *Rogenhoferia grandis* Guér.; from Brazil, *Cuterebra apicalis* Guér., (*analys*, Macq.), *C. cayennensis*, Macq., *C. rufiventris* Macq., *C. nigrocincta* Aust., *C. sarcophagoides* sp. n., *C. nigricans* sp. n., *C. infulata* sp. n., *C. schmalzi* sp. n., *Rogenhoferia trigonocephala* B., *R. dasypoda* B., *Pseudogametes hermanni* B., *P. semnatra* Wied., *Dermatobia cyaniventris* Macq., and *Gastrophilus asininus* B.

The paper concludes with notes on the parasitic habits of the American *Oestrinae*. *Dermatobia hominis* is of wide distribution. Cattle suffer most from its attack and hunting dogs less severely. Man is seldom attacked; horses are almost immune and mules slightly less so. In the case

(1) According to the *Diccionario de los diversos nombres vulgares de muchas plantas*, etc., by Dr. M. COLMEIRO (Madrid, 1871, p. 135) the "olivillo", of Chili is *Aextroacon punctatum*; for the other species, M. REICHE (*R*, May, 1916, No. 198) identifies them thus: — laurel = *Lauelia aromatica*; coigüe *Nothophagus Dombeyi*; lingue *Persea Lingue*; roble *Nothophagus obliqua*; quila *Chusquea* sp. (Ed.)

of the other indigenous species, parasitism is limited to rodents. Only a few Brazilian rodents, chiefly *Muridae* are affected.

Generally speaking females seem to predominate among the species of *Cuterebra* and *Dermatobia*. The contrary obtains in the case of *Pseudogametea*, though not to a very marked degree in *P. semiatra*.

As regards the habits of *Dermatobia*, it is confirmed that this fly sucks liquids with its proboscis. It does not appear to mate during the first few days after emergence. The eggs seem to be laid not necessarily on mosquitos such as *Janthinosoma lutzi*. Typical larvae of *Dermatobia* have been hatched from eggs taken from the left side of the abdomen of a small male of *Synthesiomyia brasiliensis* B. & Berg. These larvae preferred the dry skin of a dog to the human skin.

The author also records *Oestrus ovis* from Rio de Janeiro and neighbouring States. It is not confined to the cool mountainous zones, but is also found in the tropical regions.

73 - **Animal Trypanosomiasis at Douala (Cameroons).** — ROUSSEAU, I., in the *Bulletin de la Société de Pathologie exotique*, Vol. XI, No. 8, pp. 746-748. Paris, October 9, 1918.

During the last 10 or 12 years bovine trypanosomiasis has destroyed in the Douala region, two humbler races of cattle which, according to the natives, were autochthonous. The author has also found the presence of equine and canine trypanosomiasis.

74 - **Tests of the Treatment of Equine Trypanosomiasis in Morocco** (1). — VELU, H., in the *Bulletin de la Société de Pathologie exotique* Year XI, No. 6, pp. 448-451. Paris, June

Work from the research laboratory of the "Service de l'Élevage" of Morocco. The products used in the tests of treatment have usually been used in combination with other medicines. Owing to the current practice in human medicine they are rarely used in veterinary therapeutics as their irritating properties prevent their being given in the usual way (subcutaneous and intramuscular). Intravenous injection was used and, so as to avoid the difficulties of the ordinary needle, as owing to movements of the animals the jugular might be pierced through, a small trocar adapted to a Pravaz syringe was used.

Amongst the medicaments advised and used

1) atoxyl, thiarzol and emetic in heavy doses mostly produced a bad effect and hastened the death of animals in a very low condition while not curing the others;

2) galyol, novarsenobenzol in heavy doses, caused no immediate serious troubles that might cause the same bad influence to be suspected;

3) arsenical compounds of any kind seemed to be the most useful if given in small, repeated doses with the sole aim of keeping up the sick animal's strength so that it can fight against the parasite.

(1) See *R*, June 1918, No. 562 (Ed.)

75 - Horse Sickness in the Belgian Congo (1). — VAN SAGEGHEM, R., in the *Bulletin de la Société de Pathologie exotique*, Vol. XI, No. 5, pp. 423-432. Paris, May 8, 1918.

The disease "heartwater" is transmitted by the tick *Amblyomma hebraeum*; this tick does not exist at Zambé where, however, *Amblyomma variagatum* and *A. splendidum* occur. The author discusses previous researches (EDINGTON and COURTS, THEILER and STOCKMAN), which have shown that "horse sickness" and "heartwater" are two varieties of the same virus; thus, heartwater of sheep, when transmitted to horses, produces horse sickness in them; on the contrary, as the author has found, it is not transmissible to cattle.

The author has shown that, in mortal cases of these two diseases at Zambé, the transmitting agents were *Rhipicephalus appendiculatus* and *R. oertsi* var. *albigeniculatus*. He further found that epizootic horse sickness spread in droves of horse carefully freed from ticks and placed in a region where there were no ticks, thus showing that horse sickness can be transmitted by other means. Species of *Stegomyia*, *Anopheles*, *Hyperosia* and *Stomoxys* have been proved to transmit the disease. It may be admitted that the ticks maintain the disease in an enzootic form in a district whilst the above-mentioned insects might be the agents for rapid transmission between horse to horse, thus producing epizooties.

This transmission takes place specially over short distances; service horses passed over the whole district during an epizooty, no other precaution being taken than to keep them away from infected kraals.

The author concludes that the chief transmitting agent at Zambé is a small nematoceros fly of the genus *Culicoides* Latr., related to *C. neavei* Aust.

These small blood-sucking flies never go far away from herds. They are found with difficulty during the day; they can only be seen flying from animal to animal in the very early morning. Many *Tabanus* *plant* seen during the epizooty at Zambé were also possible agents of transmission.

PROPHYLACTIC TREATMENT. — A strong dose of camphorated oil (10 to 12 gm. of camphor) injected under the skin gave good results, especially in chronic forms of the disease. It seems that horses can be immunised by vaccination, by injecting them with progressive doses (from 0.007 to 100 gm) of virulent serum mixed with equal volumes of glycerine, and treated for 12 hours with one-quarter the volume of ether.

CONCLUSIONS. — 1) Heartwater of sheep produces horsesickness, but cannot be transmitted to cattle.

2) The virus of horse sickness gives feverish reactions in goats and sheep.

3) The virus of horse sickness and that of heartwater appear to be two varieties of the same virus.

4) Horse sickness was propagated at Zambé especially by *Culicoides* and *Tabanus*.

(1) See R., 1916, No. 315 (Ed)

76 - **The Treatment of Ulcerative Lymphangitis** (1). — VAN SAGEGHEM, R., in the *Bulletin de la Société de Pathologie exotique*, Vol. XI, No. 8, pp. 683-685. Paris, October 9, 1918.

Work carried out at the Research and Diagnostical Laboratory of the Belgian Military Veterinary Hospital. The author thinks that pyotherapy (pyo and auto-pyotherapy suggested by MM. BELIN and VELU (2) and leucocytotherapy (suggested by M. BRIDRÉ) (2) used against lymphangitis of the horse owe their curative effect to the intense leucocytosis that they cause. As sure cures have been obtained by this method the author tried to find a method which, while being practical, will give the maximum results. He substituted intravenous injections of pus emulsified in a mixture of equal volumes of oil and ether for subcutaneous injections of pus treated with ether. The method is quite safe, causes no local reaction and produces a good general reaction, which is indispensable to obtain a cure.

Pyo and leucocytotherapy give cures, but are not vaccinations, and cured animals are not safe from the possibility of fresh infection. The author, is, therefore, carrying out experiments in which he is attempting to vaccinate with living bacteria obtained from the lesions of horses suffering from ulcerative lymphangitis; he hopes to obtain an immunisation against this serious disease.

77 - **Treatment of Equine Molities Ossium**. — POISSON, H., in the *Revue Agricole et Vétérinaire de Madagascar et Dépendances*, Year III, No. 21, p. 314. Tananarive, 1918.

Osteomalacia (*Molities ossium*) of horses and mules is a disease which, though not well understood, is probably infectious and contagious. The first symptoms are shown by the digestive apparatus; the affected animal, before showing locomotor troubles, loses its appetite, voids black faeces, and is tired by the slightest work. The disease can be checked for some time by removing the animal to another place immediately the first symptoms appear and placing it to pasture on a calcareous soil, by sustaining its organism and stimulating its appetite. To this end a sanatorium, where affected animals improve considerably, has been established at Diego-Suarez on calcareous soil.

After many tests (intravenous injections of sterilised sea water, hyperalimentation with substitution food; treatments which gave no appreciable results), the author successfully cured the lack of appetite and the fatigue shown as the first symptoms of osteomalacia by giving in the daily ration 0.02 gm., in two packets, of the following powder: — powdered gentian 0.10 gm.; cinchona powder, liquorice powder, sodium bicarbonate, 0.20 gm. each; tricalcium phosphate, 0.24 gm.; kermes mineral, 0.02 gm.; caffeine, powdered digitalis, liquid perchloride of iron, sodium benzoate, 0.01 gm. each. When this powder has been given for about a month, the animals

(1) As regards lymphangitis of the horse, see R. June 1917, No. 561; R. August, 1917, No. 734; R. Feb. 1918, Nos. 177 and 178; R. March 1918, Nos. 310 and 311 and R. Sept. 1908, No. 1002. (Ed.)

(2) See R., March, 1918, Nos. 310 and 311 — (2) See R. February, 1918, No. 178. (Ed.)

regain their vigour and can work again and, if it does not bring about a complete cure, it always produces a decided improvement in the general state of health.

78 - Curative Treatment of Horse Mange. — TORTI, E, in *Il Nuovo Ercolani*, Year XXIII, No 10, pp 241-250 Turin, 1918

Before the war, horse mange attracted the attention of practitioners in a limited measure only, on account of the easy treatment and the facility of prophylactic measures, but, during the war, it has assumed such proportions in all the armies, that it alone has given more work to the veterinary surgeons than all the other diseases put together.

As the author had the opportunity of treating a group of 300 horses, he proposed to find the experimental answer to the following questions: 1) Does a remedy exist that can prevail absolutely over the others?; 2) Which treatment is preferable from the standpoint of economy and rapid action?; 3) Can horse mange be cured by an exclusively mechanico-detersive treatment, without the intervention of any medicament?

The treatment consists in:— dipping followed by washing twice all over with a 5 % sodium carbonate solution; carefully cleaning the epidermis; curative treatment (5 applications at successive intervals of 4, 5, 8, 13 days) with the mange remedy tested (which, for the different groups of animals was one of the following:— creoline; phenolised extract of tobacco; sodium hyposulphite and hydrochloric acid; soap solution of formol; sulpho-alkaline soap; HELMERICH pomade; mercurial ointment); currying; douches; cleaning and disinfection of the stables; etc.

Six weeks after beginning treatment (i. e., after 5 applications), 20 % of the animals were cured; this percentage belonged mostly to the groups treated with pomade; the rest of the animals received 2 or 3 applications of HELMERICH'S pomade or mercurial ointment, or simply melted horse fat and were then washed all over with the phenic extract of tobacco. After 20 days, 50 % of the animals, that were still affected were cured and, after two and a half months the malady had entirely disappeared.

CONCLUSION.— 1) Of all the mange remedies tested by the author there is no one that is absolutely superior as regards its therapeutic efficiency.

2) In the case of severe mange of long standing, the best treatment is the mixed one, consisting in the use of a watery solution and a fat, while, in less severe and recent cases, a simple watery solution suffices (e. g., phenic extract of tobacco); manual care should be considered as an integral part of the treatment.

3) A simple mechanico-detersive treatment (very diligent manual attention, washing with water, and, in the graver cases where this treatment does not suffice to detach the epidermal crusts, anointing with horse fat) suffices to cure mange, no matter how serious or of long standing it may be.

79 - Researches into the Influence of the Nucleo-proteins of the Udder on the Milk Secretion of the Cow. — GIULIANI, R., in *La Clinica Veterinaria*, Year XLII, No 18, pp 463-477 + Bibliography of 21 Publications, Milan, September 30, 1918

Nucleoproteins constitute the essential part of the nucleus and cell pro-

toplasm and are phosphorus compounds resulting from the combination of an albumin and a nuclein or paranuclein. The nucleoproteins extracted from the tissues and injected into animals produce various biochemical actions. These actions are specific when the corresponding metabolic function is specific for the organ from which the nucleoproteins were obtained, and general when the corresponding metabolic function is common to various organs. The nucleoproteins extracted from the parenchymatous tissues and introduced into the animal organism by injection into the organ corresponding to that from which they were obtained, produce phenomena of degeneracy when given in strong doses and may act as a cell stimulant when given in weak doses. This is why the author has considered the possibility of stimulating the secretory function of the mammary gland by injecting small quantities of the nucleoproteins of the udder into that gland itself.

The experiments were made at the Zootechnical Institute of the "R. Scuola Superiore di Agricoltura" of Milan, using 4 cows for 30 days divided into 3 periods of 10 days:— initial period (without injections); experimental period (with injections); final period (without injections). The dose injected was 10 cc. of a saturated solution of nucleoprotein in water containing 1 % sodium carbonate. The injections were repeated each day, about 40 minutes before the evening's milking. The average milk yields of the cows at the evening's milking during the initial, experimental and final periods respectively were:—

Cow I: 3.930 kg — 4.280 kg — 3.940 kg
 Cow II: 2.270 kg - 2.440 kg - 2.090 kg
 Cow III: 1.730 kg — 1.940 kg — 1.500 kg
 Cow IV: 4.710 kg - 4.850 kg — 4.510 kg.

At the following morning's milking no sensible differences were noted between the 3 periods. The cow with the greatest quantitative variations in the milk drawn after injection showed an increase of 0.255 % dry matter and 0.355 % fat with a decrease of 0.070 % lactose and 0.010 % nitrogenous matter, no variation in the ash content was noted. The milk of the following morning showed no appreciable variations in composition during the experimental period in comparison with the two others.

CONCLUSIONS. 1) The nucleoprotein of the udder introduced subcutaneously and in small doses into milking cattle has a stimulating effect on the milk secretion, shown by a slight increase in the quantity of milk and in its fat content.

2) The stimulating action is of short duration its effects only being shown at the first milking following the injection of nucleoprotein.

80 - **Crushing Locust Beans.** — GOUIN, A and ANDOUARD P, in the *Journal d'Agriculture pratique*, Vol LXXXII, New Series, Vol XXXI, No 24, pp 468 469 Paris, Nov 28, 1918

The authors do not agree with M. R. GOUIN (1) as to the necessity of crushing locust beans. M. R. GOUIN quoted cases of mishaps to horses which

(1) See R Dec, 1918, No. 1380. (Ed.)

he attributed to feeding on whole locust beans. In the experiments made by the " Association agricole " the beans were fed chiefly to pigs and horses and no ill effects were reported. Nor did the experiments justify the fear of harm being done by the woody ends of the bean. Moreover, the pods have been fed to horses from time immemorial in districts where the plant grows.

Two mares were fed on whole locust beans. One gained 908 gm. daily as compared with 821 gm. before, and the other 893 gm. as compared with 570 gm. before. Pigs gained 667 gm daily on rations ⁹/₁₀ of which were formed of locust beans, the remainder being composed of cake and bone powder. The food value of the locust bean is due chiefly to the digestible carbohydrates which an analysis made by the authors showed to be present in the proportion of 41.65 %.

81 — **The Food Value of the Water Soldier (*Stratiotes aloides*).** — DÖLSS, W., in the *Zeitschrift für Spiritusindustrie*, Year XLI, No. 22, pp 199-200 + 4 Tables. Berlin, 1918.

The water soldier (*Stratiotes aloides*), of the Hydrocharidaceae family, is very widespread in Germany. The author describes the principal morphological characters of the plant and then gives the results of chemical analyses of it made with a view to its utilisation as a food for stock. The data given by different workers do not always agree. According to STUTZER the ash of the water soldier has the following percentual composition: Potassium 23.6; sodium 16.2; calcium 18.3; magnesium 13.4; phosphoric acid 5.7; sulphuric acid 5.5; silicic acid 4.3; chlorine 13.0.

The water soldier may be fed to stock both fresh or dry and may replace the dry matter of the ration in the proportion of $\frac{1}{3}$ for horses and $\frac{1}{2}$ for cattle and sheep. Pigs will eat it fresh or boiled. The food value of the water soldier is comparable to that of meadow hay.

82 — **Animal Production in Burmah.** — See No. 1 of this Review

83 — **Horses, Mules and Donkeys in Cyprus** — *The Cyprus Agricultural Journal*, Vol. XIV, Pl. 4, pp 31-32 Nicotia, October, 1918.

Extracts are given from reports made by Captain KNAPP (1901) and Captain GOODCHILD (1917) on the breeding of horses, mules and donkeys in Cyprus. In the island preference is given to jennets for heavy transport and long journeys and to mules as saddle or draught animals. At Gastria, Carpas, there is a good type of pony from which good ponies might be obtained if the stallion were judiciously chosen. Heavy-shouldered Arab stallions were imported from Damascus but did not give good results. There is so little outward difference between a mule and jennet that the one is often sold for the other.

There is a fine breed of donkeys but the Jack donkeys are too high in the leg, run very light, are long in the back and flat-sided. Donkeys are not bred enough, nearly all the mares being used for breeding jennets. In view of the excellence of Cyprus donkey and the poorness of the horses the jennets are much superior to the mules. Jennets of from 13.1 to 14.1 hands are undoubtedly the most profitable animals to breed in Cyprus. The Cyprus

jennet is unexcelled in any country in the world for army or general pack purposes.

84 — Meat Production in Relation to the Capacity of Cattle to Gain Weight, Investigations made in Italy. — ARUCH, E. (in collaboration with FROSI and BELTRAMI) in *L'Italia agricola*, Year LX, No. 9, pp. 260-271. Piacenza, September 15, 1918

One hundred steers were chosen at Parma, all having special capacity for gaining weight, and 20 steers with the opposite characters. The two lots were kept under observation during 30 days under identical conditions and were fed identical rations. At the beginning of the experiment the 100 steers chosen weighed 88 651 lb. and at the end 94 740 lb., i. e. their live weight increased by 6 089 lb. in 30 days, or 2.29 lb. (or 0.221 %) per head daily. The corresponding figures for the 20 unselected steers were 20 565 lb., 21 025 lb., 459 lb., 0.76 lb., (0.072 %)

In a similar experiment made at Lodi, 50 selected steers gave, from September 12 to October 12, 1917:—initial weight 39 188 lb., final weight 41 406 lb., increase in live weight in 30 days 2 218 lb., daily gain per head 1.73 lb., percentual gain 0.221. The corresponding figures for twenty unselected steers were. — 20 108 lb., 20 603 lb., 495 lb. 0.825 lb., 0.822 %.

The two experiments, carried out independently of each other, gave, therefore, results which are in perfect agreement and of great importance. The author recommends the time taken up in central dépôts for observation and the necessary rest to be utilised in obtaining the greatest possible increase in live weight by removing the steers with low fattening qualities first and those with high fattening qualities last. He himself uses this method with excellent results and without any disorganisation of the service.

85 — Draught Camels in the Algerian Sahara. — COUSTON, F. (Agricultural Engineer of the South-Algerian Territories), in the *Journal d'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 21, pp. 408-411 + 3 Figs. Paris, October 17, 1918

The camel (1) is mostly used as a saddle ("mehari") or pack animal. It is little used as a draught animal, which is wrong as it is fairly intelligent and can be well broken in. Were it used for draught purposes many agricultural works could be carried out that would greatly increase soil productivity in many regions of South Algeria where the horse and mule are few and costly or even absent. If the camel were harnessed to the plough vast regions still uncultivated and where camels are plentiful could be made productive, and thousands of acres could be sown down to wheat.

Camels are little used for ploughing in Algeria, while the practice is quite common in Tunis. Thus the Sfaxiens plough their immense olive groves with camels, turning round and round the trees, which shows the animal can be well broken in. In Tunis, camels are harnessed to a small cart with two high wheels, called "araba" and used for most of the carting. Mowers, reapers, binders, cultivators can be drawn by camels, either singly

(1) The species in question is really the dromedary (*Camelus dromedarius*), with one hump. The true camel (*Camelus bactrianus*) is Asiatic and has two humps. The name camel is commonly used for both species (Ed.)

or in pairs. This has been shown at the Agricultural Experiment Institute of Tripoli, where barley was harvested with a harvester drawn by 2 camels harnessed abreast.

The camel can be also harnessed to machines for raising water, as is done in Mzab. Breaking in the draught camel is, according to Lieutenant BEL, "not difficult; as the camel is rather timid than obstinate, brutal treatment must be avoided, if quick results are wanted; the voice, a movement made with a stick or whip mostly suffice to urge them on. As with the horse, the camel must be accustomed to walking with complete harness before it is put to draw, care being taken that the men pull gradually on the swingle-trees while as many camels as possible should be placed abreast".

The author records a very successful ploughing match with camels at Biskra, in February, 1918, when 70 competitors took part. It would be interesting, at the annual competitions for distributing prizes to camel breeders, to include a class for draught camels, together with suitable tests.

86 - Egg-producing Values of Some Texas Feeding Stuffs. — HARVEY, R. N., in *Texas Agricultural Experiment Station, Bulletin No. 220*, 11 pp. + 2 Figs. + 6 Tables, College Station, Texas, October 1, 1917.

The aim of the experiments described was to determine 1) whether rations composed entirely of vegetables are as profitable for egg-production as those containing animal products (meat scraps, whey), 2) the comparative food value of skim milk, cottonseed meal, meat scrap and peanut meal, for laying hens. The experiment, begun on December 20, 1916, lasted 24 weeks. The hens were White Leghorns of good strain and were kept in enclosures. The rations consisted of milo, bran, and shorts with a protein supplement composed of skim milk for Lot 1, cottonseed meal for Lot 2, meat scrap for Lot 3, and peanut meal for Lot 4. The protein foods were given in such quantities as to supply equal amounts of protein, taking that of meat scraps as a basis. The average egg production per hen for the 24 weeks was, for each lot respectively: - 89.95, 59.95, 75.31, 56.80. The cost of producing one dozen eggs was \$0.166, \$0.199, \$0.172, \$0.205, respectively. The number of pounds of food required to produce 1 dozen eggs was 9.41, 5.75 + 86, 5.8 respectively. The lots costing most per hen gave the highest profit per hen. Hens receiving animal product were more profitable than those receiving only vegetable food. Vegetable food with a high protein content does not seem capable of replacing animal products in the ration. The hens preferred the ration containing animal products and ate it in large quantities. Sour skim milk appears more profitable than meat scraps as a source of protein when obtainable at a reasonable cost.

87 - Hen-keeping Profits in Italy, in 1918. — BRENTANA, D., in the *Rivista di Agricoltura*, Year XXIV, No. 46, pp. 374-375, Parma, November 15, 1918.

The following figures, based on the present day market conditions, refer to a small hen run annexed to a farm and rationally managed. The values given are approximate averages.

I. — COST OF INSTALLATION OF A RUN FOR 50 HENS.

	£
1) Building a hen run or adapting buildings to this purpose	20
2) Enclosure of about 240 yards round the run made of fencing or metal trellis, 7 ½ ft. high	14
3) Outfit (food and drinking troughs, pens for rearing chickens, etc)	4
4) 48 hens and 2 cocks	40
<i>Total cost of installation</i>	<i>£ 78</i>

II ADMINISTRATION OF HEN RUN

A — Expenditure.

1) Interest on capital of £ 10 (including presumed insurance and renewal) at 15 %	£ 6
2) Deterioration of buildings calculated at 2d. per head.	8
3) Food (flour, grain, vegetable scraps, food waste, hay waste, nettles, cal- culated only for the 50 original birds at £ 1.4.0 per head per annum)	60
4) True or presumed rent of land round the run (240 sq yards at 0 8d per sq yard)	0.16
5) Labour, management, supervision	8
6) Miscellaneous	4
<i>Total expenditure</i>	<i>£ 86.16.0</i>

B — Receipts

1) 6 000 eggs at an average price of 4d each.	100
2) Net profit on 10 capons.	6
3) Net profit on 40 pullets and cockerels.	15
4) Chicks, valued at 6 ½ per head annually	1.7
<i>Total receipts</i>	<i>£ 122.7.0</i>

Summary

Receipts	£ 122.7.0
Expenditure	86 6 0
<i>Net profit</i>	<i>35.9.0</i>

88 - **Bee-keeping in Spain.** — *Revista de la Cámara agrícola balear*, Year XX, No. 21, pp 161-162 Palma de Mallorca, November 10, 1918 — *The British Bee Journal*, Vol XLVI, No. 1898, pp 363-364. London, November, 1918

The number of hives existing in Spain (nearly all in the Valencia, Aragón, Valladolid, Guadagara and Majorca regions) is estimated at 1 600 000. The annual yield of honey is estimated at about 19 million kg. which, at 2.50 francs the kg., represents a value of 47 500 000 francs, to which should be added that of the wax. It is estimated that by using suitable methods a yearly outturn worth 60 million francs could easily be obtained.

89 - **Silkworm Rearing in Tripoli.** — MAZZOCCHI-ALEMANNI, N in *L'Agricoltura coloniale*, Year XII, 1st Half-year, No. 3, pp 167-190 + 18 Fig- Florence, June 30, 1918.

Silkworm rearing experiments carried out in Tripoli in the spring of

1915 (1) yielded only a few grammes of eggs. The first silkworm rearing season of 1916 gave the following results :— about 880 lb. of fresh cocoons corresponding to 297 lb. of dried cocoons yielding a gross income of 2 424 *lire* (1 *lira* — 9 ½ *d.* at *par*). A prize of 574 *lire* was distributed among 11 rearers. In all there were 20 silkworm rearers that year.

In 1917 the production rose to 2 645 lb. of fresh cocoons which yielded about 880 lb. of dried cocoons and a gross income of 11 300 *lire*. Prizes to the value of 775 *lire* were distributed among the 21 best rearers. The increase in production from one year to the other was 300 %.

During these two years were distributed free of charge a large number of white mulberry trees, some from Italy, some grown in the country itself by the Agricultural Experiment Institute. In 1916, 2 371 plants were distributed and in 1917 9 743, i.e., more than 12 000 plants in two years.

The results obtained and a minute study of the possibilities of silkworm rearing in Tripoli show that it might be well developed to the great advantage of the colony. There are several difficulties to overcome, but this might be done fairly easily. If silk-production cannot increase in subsequent years in the same proportion as these first ones, everything points to the likelihood of an important development. If, at the present juncture, it seems premature to think of founding a silk factory, a small experimental one might be started. The future of silkworm rearing in Tripoli seems to be assured so long as it is not left unsupported and the Administration continues to give it help and guidance.

90 - Regulation of Silkworm Egg Production and Commerce in Italy. *Gazzetta Ufficiale del Re no d'Italia*, Year 1918, No. 235, pp. 2863-2864 Rome, October 5, 1918.

In view of the expediency of regulating by legislation the production of and commerce in silkworm eggs in order to assure the Italian silkworm industry healthy eggs completely free from inheritable disease, and to prevent the production and sale of eggs empirically prepared, the decree No. 1382 of May 9, 1918 was issued. It contains the following clauses :

1) Whoever wishes to sell or prepare for sale silkworm eggs must obtain the authorisation of the Ministry of Agriculture. This authorisation is also necessary for eggs exchanged or given free of charge. It is not necessary for persons who for three years have been inscribed in the local Chamber of Commerce and Industry as preparing silkworm eggs if they produce annually an average of 5 000 ounces of eggs of pure race and 1 500 ounces of mixed race and are supplied with the buildings, instruments and machines necessary to the good preservation of the eggs they produce. Such establishments must use for breeding-purposes at least 1 % of their eggs if they are of the native yellow race and 1.25 % if they are of Asiatic races.

2) Races already crossed must not be reared for breeding and crossing. Asiatic eggs may be sold only by persons holding a special authorisation or by those exempt from such authorisation by the decree

(1) See *R. Feb.*, 1916, No. 213 (*Ed.*)

3) Silkworm eggs may be imported into the kingdom only in small boxes containing laying moths.

4) The sale of eggs by travelling merchants is forbidden. The eggs may be sold in small boxes or loose.

To test the eggs an analysis will be made by a government institute nominated by special decree of the Ministry of Agriculture. All infected eggs will be destroyed.

91 - Creation of a Bureau for the Examination of Silk Goods at Yokohama, Japan.

— *Bulletin de l'Association séricicole du Japon*, Year III, No. 2. Tokyo, September 15, 1918.

By a decree dated March 30, 1918, the Japanese Government has founded a bureau at Yokohama for the examination of silk goods which includes 3 sections: the first is chiefly occupied with the examination of the quality of the various forms of raw materials, i. e., silks; the second deals with operations relating to fabrics, braid and tricots; the third, with work on the preparation and finishing.

The essential aim of this bureau is to improve Japanese silks, but weaving tests are also made with the different varieties of silk produced throughout the world, by means of the best looms in use in all textile countries.

92 - Investigations into the Variations of Colour in Cocoons in Japan. — WATANABI, K

in the *Bulletin de l'Association séricicole du Japon*, Year III, No. 2, pp. 1-3. Tokyo, September 15, 1918.

The author (agricultural graduate of the Silkworm-breeding Laboratory of Tokyo) carried out experiments to determine the influence of season and temperature at the time of rearing on the colour of silkworm cocoons. As a rule all the cocoons of a pure race are uniform in colour. Nevertheless cases occur in which worms of the same race give cocoons of different colour. The Onodahime race, which gives four yields of yellow cocoons is a good example of this and was used for the experiments. This race gives, in spring (1st period), pale, yellow cocoons; in summer and the beginning of autumn (2nd and 3rd periods), dark yellow cocoons, and, at the end of autumn (4th period), pale yellow cocoons resembling those of the 1st period.

The changes in the colour of the cocoons according to the rearing period are due chiefly to the differences in temperature to which the silkworms are subjected at the 5th stage. If larvae are kept, during the 5th stage, at a constant high temperature the longer they are exposed to this temperature and the higher the temperature the darker will be the colour of the cocoons. If the larvae are kept at a very high temperature which is varied slightly, those which have been subjected for a long time to a slightly lower temperature give darker cocoons than those subjected to a slightly higher temperature for a shorter period. In the case of very low temperature, a small difference causes a very marked variation in the colour of the cocoons.

If, during the 5th stage, the moisture conditions are varied and the temperature kept constant, the colour of the cocoons varies a little, the

larvae kept in very damp surroundings giving distinctly yellower cocoons. The influence of moisture is, however, much less strong than that of temperature. When the temperature during mounting is too high the cocoons are of a more brownish-yellow than those produced at a relatively lower temperature. Cocoons woven in very moist air are dark.

The Onodahime race is not the only one the cocoons of which vary in colour with the temperature. Not only yellow cocoons, but also those of a bamboo leaf green change colour with the temperature.

93 - Incubation of Trout Eggs in a Sterile Medium, Poor in Oxygen. — MURISIER, P. in the *Archives des Sciences Physiques et Naturelles*, Year CXXIII, Vol. 46, Period 4, pp. 255-256. Geneva, October-November, 1918.

Results of the authors' experiments on incubating trout eggs in a medium both sterile and poor in oxygen. These environmental conditions are obtained in the following manner: — 800-1000 cc. flasks are filled with water brought to the boil 3 times a day, each time for one hour; whilst cooling the air that redissolves in the water is filtered through sterilised cotton. When this is done, 50 fertilised lake trout eggs are placed in each flask, which is lightly closed with a rubber stopper. As long as the experiments last the flasks are not opened, nor is the water changed.

Out of 250 trout eggs incubated in this way during the years 1915 and 1916, at temperatures of 7, 8 and 10°C., with experiments lasting from 50 to 60 days, not a single case of death was observed, from which it may be concluded that the egg of the trout can live in a stagnant medium that is poor in oxygen, provided that the medium is sterile and free from contact with the surrounding air.

DEVELOPMENT OF EMBRYO AND HATCHING. — In 1915, eggs weighing 250 gr. and fertilised artificially were placed in an incubator of the "Californian trough" type, containing 10 litres and fed by strongly oxygenated spring water at the rate of 10 litres per minute. On the third day after fertilisation, 50 eggs were placed in each of 2 water bottles sterilised as described above, one of 1000 and the other of 800 cc. capacity. The bottles were hermetically closed and placed in a recipient attached to the incubator and supplied with the water leaving the incubator in such a way that the temperature was the same everywhere (average temperature of 8.5°C.).

In the incubator with running water the eggs hatched on the 53rd to 58th day after fertilisation; the fry on hatching measured 17-18 mm. None of the eggs in the bottles containing sterilised water died during this period. In the first bottle, containing 1 litre, hatching took place on the 55th to 58th day, but the fry, on leaving the egg, only measured 12-13 mm. The eggs in the 800 cc. bottle did not hatch, although they continued to live until the 75th day after fertilisation. At that date they had a muddy appearance, and the embryo appeared as a whitish streak when seen through the shell. On opening them, the dead embryos were found to measure only 11 mm. on an average.

CONCLUSIONS. — 1) The duration of the incubation of trout eggs (fer-

tilisation to hatching) is independent of the quantity of oxygen contained in the medium (comparison between the incubator with running water and the bottle containing sterilised water), provided that the quantity present is sufficient to allow the fry to attain a minimum size of 12 mm. in the normal time fixed by the temperature (comparison between the 1 litre and 800 cc. bottles.)

2) The hatching of the egg does not mark a determined state of development of the embryo and it can take place as soon as the embryo is 12 mm. long

3) The smaller the egg is the more difficult it is for the fry to leave the egg; in normal cases (hatching at 17-18 mm) the shell is thinned all over its surface, while the thinning is localised at the embryonic area in eggs deprived of oxygen. In addition the fry hatched when 12 mm. long are abnormal; their dwarf condition is not surprising, considering the deprivation of gaseous food, but it is interesting to note that, in relation to their length, the cephalic end and the eyes show a remarkable atrophy.

FARM ENGINEERING.

94 - **Temporary Tractor Courses in Ohio, U. S. A.**— *The Department of Agriculture of Ohio, Official Bulletin*, Vol. 1X, No. 1, pp. 4-10 + 1 Table. Columbus, February, 1918.

Temporary tractor courses were held between February 11 to 16, 1918, at Columbus, being attended by 1500 farmers; 18 makes of tractors were used for the practical demonstrations. In Ohio, nearly 3000 tractors are now in use and an increase of 100 % in the tractors used is expected for the current year. The great number of persons that attended the course is not considered very remarkable, but the great interest with which the farmers followed the practical demonstrations is considered of much greater importance. For this reason it has been decided that, in future, the course will be given each year. The upkeep of the tractor, working troubles and how to prevent them, the various parts of the tractor, have all been treated in a practical way by the lecturers. The bulletin describes in detail the chief points dealt with regarding trouble that occurs during work :- quality of fuel; good compression; sparking.

Data furnished by tractor owners in Ohio are summarised in a table. —

Twenty-two tractors are of 5-10 H.P., 51 of 6-12 H.P., 266, of 8-16 H.P., 30 of 9-18 H.P., 216 of 10-20 H.P., 83 of 12-24 H.P., 76 of 12-25 H.P., 22 of 15-30 H.P., 6 of 18-36 H.P., 9 of 20 H.P., 4 of 25-50 H.P., 7 of 30-60 H.P.

As regards the gross weight, 9 tractors gave an average of 1980 lb. each, 103 of 2992 lb., 84 of 3060 lb., 348 tractors had an average weight of 4994 lb., 181 of 5993 lb., 18 of 6772 lb., 19 of 7770 lb., 5 weighed 9011 lb., 7 weighed 9977 lb., 18 weighed more than 14960 lb., 5 more than 17820 lb. and 4 nearly 22000 lb.

553 tractors towed ploughs with 2 mouldboards, 266 with 3, 25 with 4, 9 with 5, 4 with 6 and 3 towed ploughs with 8 mouldboards.

803 farmers are satisfied with their tractor, while 89 gave an unfavourable reply. As regards the difficulty of renewing parts of tractors 825 had no difficulty; 63, on the contrary had had difficulty in obtaining spare parts; 684 farmers said they were prepared to hire out their tractors, and 168 were not. The average cost of ploughing per acre is 2 dollars 83 cents.

95 - **Importation of Agricultural Machinery into Russia during 1917.** — *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No 46, p. 4. Paris, November 12, 1918

The "Torgovo Romychlennaia Gazeta" (1) has published the latest statistics regarding the importation into Russia, across European frontiers, of agricultural machinery and implements for the first 8 months of 1917, in comparison with the same period of the 4 previous years, as is shown by the following table: —

Years	Quantities in thousands of <i>pounds</i> (2)	Value in thousands of <i>roubles</i> (3)
1913	7 039.6	41 828
1914	6 754.9	37 978
1915	120.5	1 029
1916	481.0	5 226
1917	1 285.7	16 726

This table shows that the machinery imported during the first 8 months of 1917 represents 18 % of the importation in 1913, while it is 10 times greater than that in 1915, always for the same period. As regards the kinds of machinery imported this is shown in the following Table (in thousands of pounds): —

	1913	1916	1917
Machine for cultivating	1 202	2.5	19.3
Dills, etc	510	—	7.1
Harvesters	1 998.9	234.8	1 112.2
Threshers	932	7.7	7.3
Separators and cleaners	77.5	—	0.9
Machinery for forage	57	—	3.8
Mechanical engines	945	—	9.5
Other agricultural machinery	1 317.2	236	1 14.6

Amongst the chief countries that exported these machines to Russia before the war, Germany took the first place with 33 % of the total import followed by the United States with about 30 %, England with 17 %, Aus-

(1) Quoted by the *Bulletin de la Chambre de Commerce Russe à Paris*, No 9, 1918

(2) 1 *pound* — 36 11 lb (3) 1 *rouble* — 2 s 1½ d. at par (Ed)

tria, etc. Since the war this situation has changed; in 1917, the United States furnished 77.6 %, Sweden about 10 %, followed by Finland and England.

96 - **The Use of Tractors in Cuba.** — *Farm Implement News*, Vol. XXXIX, No. 40, p. 27 Chicago, October, 1918.

According to Mr. C. H. WINANS, U. S. Consul at Cienfuegos, Cuba, there is at present an excellent market in that district for the sale of tractors. This is due to the fact that the various sugar mills are to a rapidly increasing extent using tractors instead of oxen for ploughing. An average sized sugar mill near Cienfuegos which previously employed 2 tractors now has 6 in operation. This shows how tractor ploughing is spreading in Cuba. The chief advantage in using tractors is the saving in labour; besides, the tractor does more uniform work than that done by oxen. These advantages more than outweigh the greater expense involved. Experiments made with tractors for the transport of sugar cane have not proved successful. The tractors used in Cuba are made in the United States. It appears that the steam cable plough, though it has given satisfactory results, is no longer purchased owing to its high running expenses.

97 - **The Agricultural Utilization of Tanks and Heavy Tractors.** — CADORET, A., in *Les Alpes Industrielles*, Year 1, No. 17, p. 133 Grenoble, November 23, 1918.

To level trenches and shell holes the author suggests the use of tanks and heavy tractors for hauling digging ploughs, double mould-board ploughs and heavy levellers. Coupled in pairs, at adjustable distances, the cultivator tanks would soon fill up the cavities. A leveller placed between 2 tanks, capable of moving 1 or 2 cubic metres, would finish off the rough work.

The shell holes would at first be attacked simultaneously on all 4 sides with digging ploughs, following immediately after with the leveller. Once the rough general levelling is done, the large tractors, would be used, transformed into hauling tractors or agricultural tractors, to finish all the operations preliminary to sowing.

Powerful chain or wheel tractors are available which only require fitting out. The tanks could also be used for opening the ditches bordering on the roads or for drainage. Tanks or tractors fitted with cable drums could be adapted to do digging work by the FOWLER method.

98 - **The Use of Tractors for Lifting Beets.** — PLUCHER, E., in the *Comptes rendus des Seances de l'Académie d'Agriculture de France*, Vol IV, No 31, pp 940-945 Paris, November 6, 1918

The author communicates a note by M. BACHELIER, describing observations suggested by the use of a tractor in lifting beet on the Mormant estate. In 1918 M. BACHELIER used a 40 H.P. FILTZ tractor (1) towing a BAJAC lifter working on 3 rows, the front wheels of the tractor straddling over one row, the back wheels arranged specially so as to pass in the spaces

(1) See R., Oct 1918, No. 1145 (Ed.)

between the drills. Work was begun right away, no adjustments being required.

The machine is very easy to steer; the beet lifter does not deviate from a straight line, as always happens with a team of horses; no roots are damaged and the work is perfect. On an average 3 hectares were lifted per day, with a consumption of 22 litres of petrol per day.

The cost of the work appears to be much the same as with a team, but, with the tractor, the work is done much more quickly, leaving free the teams that are so urgently required for other work at that time. "It is not a question of chance, says M. BACHELIER, in conclusion, that the tractor moves in the beet field without causing the slightest damage. Here, as in many other cases, one can see the value of the practical men, who had been consulted as to the construction of the tractor."

The tractor replaces 12 oxen, and, as M. PLUCHET says, such an economy is of serious value at that time, when sowing is being done. Regarding tractors, the author points out how numerous are the farmers in the Paris district who, after the harvest, have used the tractors for breaking-up stubble, shallow cultivation, and, finally, for autumn ploughing. He considers that, thanks to this equipment, the land in his district has been got into excellent condition; such work on the land, which had been neglected for several years, well certainly have a good effect on the crops.

99 - The System of Electric Ploughing (1) of the "Société Générale Agricole". — SONIA, P., in *La Petite Revue Agricole et Horticole*, Year XXIV, No 566, pp 154-155 Antibes, October 17, 1918.

M. AMÉDÉE PETIT, Delegate Manager of the "Société Générale Agricole", 44, Rue du Louvre, Paris, has just finished a windlass machine for electric ploughing.

The S. G. A ("Société Générale Agricole") electric ploughs consist essentially of 2 windlasses alternately pulling a reversible balance plough, with 6 shares for ploughing to 20-25 cm., and 4 shares for depths of 30 cm. and digging 12 cm. in addition. They can work on lengths of from 200 to 630 metres over surfaces of at least 4 hectares. They work on a power station to be founded or from a distribution network. In both cases the current is supplied from fixed, generally high tension wires. It is taken to a movable transformer cabin by a free cable laid on the ground or carried on light, displaceable posts.

The feed lines from the movable transformer cabin supply the windlasses in the fields. The plant works with mono, bi or triphase current of any periodicity of high voltage up to 25 000 volts. The windlass frame carries in front a 50 H.P., 4 cylinder heat engine and, behind, an electric motor, of 100 H.P. (synchronous triphase) continued, and 150 H.P. for a short period. The heat engine is used when the area to be ploughed is too large for the cable or in case of a breakdown of the current.

The 2 motors drive a transverse shaft through a compound gear box,

(1) See R, Dec 1917, No 1202; R, April, 1918, No. 453 and R, Oct. 1918, No. 1144. (Ed.)

the transverse shaft drives, on one side, through a grooved pinion, a gear driving the rear wheels, and thus moving the machine forward ; on the other side the shaft drives, by a conical member which, through clutch, drives a toothed wheel, wedged on the drum with a vertical axle, on which the steel cable rolls for hauling the agricultural implements.

Each windlass is in charge of 1 man. When the work is done, each windlass is coupled up to the plough, forming 2 trains which move at a speed of 6 kilometres per hour towards the next work. The staff is housed in the movable cabin, divided into 2 parts, one containing 8 beds and the necessary furniture, the other acting as a transformer cabin. The S. G. A. set has the advantage that the machines work day and night ; there is a saving of 6 oxen, 2 men, and coal ; automatic safety devices ; quick work no matter how sloping the land is. —

As regards the work the S. G. A. guarantees : in open loam in good condition, without stones, without too much undulation for ridges at least 400 metres long :

a) for the yield per hour : — ploughing at 15 cm., 100 to 110 ares ; per 10-hour day, 10 to 11 hectares ; ploughing at 22 to 25 cm., 75 ares per hour ploughing at 30 cm. + 15 cm. digging, 50 to 55 ares per hour

b) for the consumption : — ploughing at 15 cm., 35 kilowatts per hectares ; at 22 to 25 cm., 45 kw ; at 30 + 15 cm., 90 to 100 kw

100 - **The International Harvester Corporation's Sheaf Shocker.** *The Implement and Machinery Review*, Vol. XXXIV, No. 52, p. 702 + 1 fig London, November 1, 1918.

Description of the sheaf shocker (1) made by the INTERNATIONAL HARVESTER CORPORATION of Chicago. As the bundles come from the binder deck, they are transferred by a fork to the shock setter, the bundles being alternately deposited first on one side of the setter and then on the other, the butts being spaced and the tops overlapping, so as to make a wedge-shaped shock. When the setter has received sufficient bundles to make a shock, a trip is automatically operated, this causes the shaft of the shocker knoter to rotate and to operate the compressor arm and the needles, which compresses the bundles and ties them together. The shock-setter is wider at the rear than at the front to assist in making shocks that will stand well when discharged. It is provided with an inclined bottom, which is pivoted, permitting it to tilt to the rear and discharge the shock after it is compressed and tied. The arm under the shock setter has a roller at the end which comes in contact with the shock setter bottom. This arm is rocked in such a way as to tilt the bottom of the shock setter with a quick movement which sets the shocks squarely on the ground. When the shock-setter tilts to discharge the shock two times spread the butts of the back and corner bundles to give the shock a substantial base. The crankschaft of the binder transmits the necessary driving power to the shocker, and the draft connection between the two machines allows the shocker to move independently of the binder when working on uneven ground.

(1) See *R*, Nov 1917, No. 1055. (*Fd*)

This machine was much used in 1918 in American and Canadian harvest fields, but it will not be placed on the European market until its success has been completely established in America.

101 - **Technical Considerations on the Use of Sorters.** — RINGELMANN, M., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 29, pp. 810-814 and No. 30, pp. 843-846 Paris, October 2 and 9, 1918

In a communication to the French Academy of Agriculture on the use of sorters, the author recalls that he carried out tests on the agricultural model of the MAROT sorter, with a diameter of 47.2 cm, and an alveolar cylinder 2.098 metres long, then worth 330 francs and costing, in 1917, 963 francs

This machine can deal with 4 hectolitres of wheat (11 bushels) per hour; to obtain perfect sorting not more than 200 litres of seed must be fed to the sorter per hour, which, with loss of time owing to adjustments and ordinary stoppages amounts to a practical delivery of 150 litres per working hour. To sort well, the thickness of the layer of seed in the cylinder, the slope and speed of this latter, should not exceed certain limits, or a fairly large amount of seed will not be thoroughly sorted. By repeated tests the author found that the best conditions for different wheats (1 Prince Albert wheat and 1 March Saumur wheat) corresponded to 38 turns of the handle per minute and, to sort 100 kg. of wheat, 500 turns of the alveolar cylinder and 1818 turns of the handle, little energy is required (2 kilogrammeters per second).

Some March Saumur wheat, bought from a seed merchant as seed wheat gave the following results (by weight) on sorting various seeds, waste, 15.4 %, small and broken seed, suitable for poultry, 46 %, medium wheat that can be used for milling, 23.2 %; fine seed wheat, 56.8 %. Thus, to obtain 100 kg of seed wheat 176 kg of seed sold for sowing had to be treated. In order to find the effect of sorting on the crop obtained, in 1893 the author, in collaboration with M. F. BERTHAULT, Professor of Agriculture at Grignon, carried out tests with March Saumur wheat, drilled in spring in loamy soil, at the rate of 260 litres of seed per hectare. Saumur wheat is a soft, beardless wheat, requiring little attention, early, and giving as much as 25 quintals per hectare in the Beauce region. The results, reported to the author's friends and pupils, were in 1893, an abnormally dry year, as follows for unsorted and sorted wheat per hectare: drilled, 260 and 260 litres; grain harvested, 1668 and 2885 kg.; straw, 5800 and 7000 kg., chaff and small straw, 532 and 915 kg., total crop, 8000 and 10800 kg., hectolitres obtained, 21.60 and 36.65; weight per hectolitre of wheat obtained, 77.2 and 78.7 kg. The increase in favour of sorting is 1217 kg of grain, 1200 kg of straw, 383 kg of chaff, etc., and 2800 kg for the total crop.

Besides the obvious influence of sowing better seed obtained by sorting or mechanical selection, the increase is due to the diminution of weeds, which absorb water to the detriment of the wheat, this was all the more so as 1893 was a very dry year. From a scientific standpoint the author concludes that sorting, as it leaves a certain amount of water available for the plants, constitutes a special kind of *irrigation*.

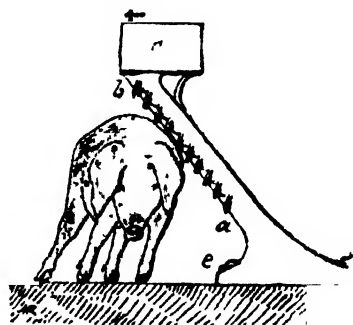
According to M. GAROLA, a spring wheat yielding 6 000 kg. per hectare (2 000 kg. of grain and 4 000 kg. of straw) and representing 5 100 kg. of dry matter (the crop contains 15 % of water), absorbs 1 720 cubic metres of water, or a layer 172 mm. thick. According to several investigators, spring wheat has to evaporate 338 gm. of water in order to elaborate 1 gm. of dry matter; the author carries this figure to 340 in the following calculation. The extra crop shown above consisting of 2 800 kg. per hectare, containing 16 % of water, represents 2 450 kg. of dry matter, or a consumption of 83 kg. of water per sq. metre, or a layer of 83 mm. of water that has not been absorbed by weeds in that part of the field sown with sorted wheat, and which remains available for the wheat.

In an average year the annual rainfall at Grignon is 537 mm., with a general average of 147 mm. of rain for April, May and June; the figures for 1893 were much less. The 83 mm. of rain calculated above show clearly that mechanical sorting (as well as a better choice of seed and, for the same amount of seed, a greater number of good seeds distributed per unit of surface) has resulted in leaving more water at the plant's disposition, it is thus an indirect method for providing the crop with water. The author thinks that the increase by 1.5 kg. of the weight per hectolitre of grain is due especially to selection of the seed through sorting. Plant physiologists give no data regarding the water requirements of weeds. The author thinks that by sowing well selected seed mixed with weed seeds, the crop would be less, the conditions being the same, than that obtained by sowing less fine seed, free from weed seeds. The question of seed purity thus seems to precede that of selection as regards agricultural hydraulics.

102 - **American Hog Oiler.** - RINGELMANN, M., in the *Journal d'Agriculture* - Year I, XXXII, Vol. XXXI, No. 20 p. 308 - 1 fig. Paris, October, 1915.

In the large piggeries of the United States hog oilers (1) are used, mounted on a cast iron stand fastened to the ground. Some models have 3 vertical brushes, others, apparently more suitable have a single brush *ab* (see Fig.) fixed at a slant under the reservoir *c*; the foot *de* should be firmly fixed to the ground to withstand the pressure caused by the pig.

In Illinois, one hog oiler is said to be sufficient for an enclosure containing from 30 to 50 pigs. The liquid used is an antiparasitic oily compound or water to which are added a few drops of creolin or cresyl. The flow of the liquid, regulated by a small tap, is about 6 to 10 cc. per hour.



American hog oiler

(1) Several hog oilers have been recorded in the Review of Patents in various previous numbers of this Review (*Id.*)

103 - **The Utilisation of Industrial Alcohol and Hydrocarbides for Carburetting in France.** — *Le Génie civil*, Vol LXXI, No 11, pp 225-228 Paris, October 6, 1917.

In 1916 the Ministry of Commerce and Industry charged Messrs. L. PÉRISSE and GUISELIN to prepare a general report on the carburetting resources of France Messrs. LÉTOMBE and MACLÈRE at the same time undertook a long, detailed investigation into alcohol and their report is appended to the general one mentioned.

The production of alcohol in France rose to an average of 68 200 000 imperial gallons before the war, alcohol for human consumption produced by the fermentation of fruit, or industrial alcohol made from beets, molasses and cereals. This last represented about $\frac{3}{4}$ of the alcohol produced annually, i e., about 50 600 000 galls. France and the United States dispose of a greater variety of substances suitable for the manufacture of alcohol than any other country. The copse of the forests of France and her colonies could, in addition, supply the necessary material for the production of enormous quantities of industrial alcohol. Synthetic alcohol is also made from calcium carbide which produces cheap acetylene, from which, by means of an electric arc, is obtained ethylene which yields sulphuric acid, sulphurous acid and alcohol. By another method the acetylene produced is passed into a one thousandth solution of mercuric-chloride which fixes the elements of the water forming acetaldehyde or ethylaldehyde, which is separated by heating and changed to alcohol by hydrogenation. Whereas in France the synthetic production of alcohol is limited to laboratory experiments it appears already to form an industry in Germany.

In France the quantity of denaturalised alcohol used industrially has risen to 13 200 000 or 15 400 000 galls only, 20 to 25 % of the total production. In Germany it increases regularly, exceeding 288 % in 1901 and 49 % in 1913 The French denaturant used is composed of methylene containing 25 % of acetone and at least 2.5 % of pyrogenic impurities ; 100 galls of at least 90 % alcohol contain 10 galls. of methylene. The quantity of methylene will probably be greatly reduced in the future. Already before the war Germany used only 0.75 % of methylene with 0.25 of acetone, 0.25 of pyridine, and at least 2 % of benzene. Motor alcohol must be of a definite chemical composition and fairly constant calorific quality which must not be injured by the denaturant. It is also essential that the price be stable. The French fiscal laws are complicated and result in an insufficient use of alcohol industrially. Whereas France consumed in 1913 15 928 000 galls of denaturalised alcohol, or 0.40 galls. per inhabitant, Germany used 37 928 000 galls, or 0.99 galls. per inhabitant. The modifications which the French Government wished to introduce should reduce the consumption of drinking alcohol to 2 200 000 galls., the 13 200 000 to 1 540 000 galls thus set free to be utilised by industry.

The net cost of alcohol can hardly be less than 1s. 4d. to 1s. 5d. per gall.; with the cost of transport and sale this comes to 2s. 2d to 2s. 4d. per gall., a price at which alcohol cannot compete with petroleum for lighting pur-

poses. It should be possible to fix the price of alcohol for burning at $10\frac{1}{2}d.$ The practical value of a carburetting substance depends on its low calorific power, so that its commercial value should be in proportion to this factor. If, for alcohol, the low price of $10\frac{1}{2}d.$ be admitted, then the value of petrol and benzene should be $1s. 7d.$ and $1s. 7\frac{1}{4}d.$ per litre respectively. Before the war they cost $1s. 7\frac{1}{2}d.$ and $1s. 2\frac{1}{2}d.$ respectively. To sell motor alcohol at $1s. 7\frac{1}{2}d.$ the State should grant a premium of $19s. 9d.$, i. e., about £4 500 per million gallons. The tax of £24 on drinking alcohol proposed by the Government would supply the money for this premium. It would suffice even if the substitution of alcohol for petrol for motors be considered. This would lead to an increased consumption of 132 000 000 to 154 000 000 galls. of pure alcohol, desirable both for industry and agriculture. It remains to be proved that motors with 90 % denaturised alcohol can work normally by means of decreased pressure, modified distribution and a special arrangement for heating and starting. The best solution would be to use a mixture of alcohol, hydrocarbide and ether in spirit motors.

The General Omnibus Company of Paris used, for its motor buses, carburetted alcohol with 50 % of benzene without modifying the motors, a simple adjustment of the nozzles sufficed. Consumption is greater than when petrol or pure benzene are used, and the instability of the prices of alcohol and benzene is against this mixture. The investigations mentioned bear on:— 1) mixtures containing the most alcohol and least carburetting substance possible, 2) carburettors allowing the use of more alcohol in the mixtures; 3) the modification of existing motors with a view to decreasing the consumption of alcohol per unit of power; 4) a motor capable of utilising pure alcohol. So far it has only been possible to increase the proportion of alcohol and decrease the carburetting substance in motors by adjusting the nozzle and admitting the air of the carburettor. This result was obtained with a mixture called "E. H. A.", composed of 65% of 95° or 96° alcohol, 10% of ether and 25% of a hydrocarbide. With this mixture starting is easy, the consumption does not appreciably exceed that of petrol, and the speed is about the same. These good results obtained on the road are easily explained: vaporisation of the alcohol at a lower temperature is favoured by the hydrocarbide, ether helps to start cold motors, consumption is low because with the varied loads on the road, a mixture with a basis of alcohol containing ether burns more completely than petrol. For fixed motors and lorries, the loads of which vary little, the results are different and the consumption in volume is in about the inverse ratio to the calorific power (5 850 calories for the E. H. A. mixture and 8 000 for petrol). The report gives data on the resources of France, Alsace, and the French colonies, in petroleum and natural gases. The bituminous schist is not as important as petroleum, but, with new methods, the schist industry could become profitable. It is of added interest because it can help in the development of the industrial use of alcohol by supplying it with the elements necessary to carburet it. It is estimated that 1 320 000 galls. of oils suitable for internal combustion motors might be produced from schist in France.

104 - Review of Patents (1).

TILLAGE MACHINES AND IMPLEMENTS. — *Canada* : 185 390 Scraper for disc plough ; 185 609 Land clearing machine ; 185 656 Scraper.

Denmark : 23 507 Cultivator tine

Spain : 67 379 Improvement to disc harrows.

Sweden : 43 739 Land clearing machine ; 43 804 Harrow tooth fastener ; 43 805 Motor plough.

United Kingdom : 118 421 One-way plough ; 118 933 Adjustable subsoil attachment for plough ; 118 939 Odometer wheel attachment for plough, mowing, reaping and other agricultural cultivating machines ; 119 048 Motor balance plough

United States : 1 276 720-1 277 542-1 278 031-1 278 574-1 279 588-1 280 057 Ploughs ; 1 276 843 Process and machine for soil-tillage ; 1 277 163 Stump pulling machine ; 1 277 400 Adjusting mechanism for disc harrow , 1 277 780 Rotary cutter earth plough, cultivator and ditch-digger ; 1 278 793 Spring tooth harrow , 1 278 795 Combination lump crusher, harrow and roller ; 1 278 939-1 279 792 Plough raising mechanisms ; 1 279 677 Front truck for cultivators and other agricultural implements ; 1 279 689 Cultivator ; 1 280 011 Tractor plough

DRAINAGE AND IRRIGATION. — *Sweden* : 43 708 Digging wheel for ditching machines

United States : 1 277 353 Ditch digging machine ; 1 278 217 Apparatus for irrigating plants.

MANURES AND MANURE DISTRIBUTORS — *United Kingdom* : 118 692 Manure and seed distributor.

United States : 1 280 103 Fertiliser distributor

DRILLS AND SEEDING MACHINES. — *United Kingdom* : 118 692 Manure and seed distributor.

United States : 1 276 900-1 277 228-1 278 573-1 279 545 Seed planters ; 1 277 099 Hand seed drill.

VARIOUS CULTURAL OPERATIONS — *United States* : 1 279 049 Two row cultivator , 1 279 435 Riding attachment for maize cultivator

(1) *The Canadian Patent Office Record and Register of Copyright and Trade Marks* Ottawa, Canada

Dansk Patentsindsendelse af Patentkommissionen Copenhagen Denmark

Octrooiaad Nederland, Octrooi, Bureau voor den Industrieelen Eigendom, The Hague, Netherlands.

New Zealand Patent Office Journal Published by Authority Wellington, New Zealand

Boletín de Agricultura Técnica y Económica, Órgano Oficial de la Dirección General de Agricultura, Minas y Montes, Ministerio de Fomento, Madrid, Spain

Beskrifning Öfverlygghörd av Kungl. Patens-och Registreringsverket, Stockholm, Sweden

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The Illustrated Official Journal (Patents) Printed under the Authority of His Majesty's Stationery Office, London

The Official Gazette of the United States Patent Office, Published by Authority of Congress Washington D C, United States

CONTROL OF DISEASES AND PESTS OF PLANTS. — *United Kingdom* : 119 126 Hydrocyanic acid for the fumigation of fruit trees.

United States : 1 277 122-1 277 575 Animal traps ; 1 277 354 Insect trap ; 1 277 531-1 279 476-1 279 477 Insect gathering and destroying machines.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *United Kingdom* : 118 492 Horse sweep rake ; 118 562 Flax pulling machine.

United States : 1 277 120 Peanut digging attachment ; 1 277 257 Guard attachment for harvesters, etc. ; 1 277 551 Sweep rake ; 1 277 616 Grain shocking machine ; 1 277 715 Berry harvester machine ; 1 277 851-1 277 901 Cotton harvesters ; 1 278 000-1 279 542 Harvesters ; 1 278 102 Grain harvester pushed by tractor ; 1 278 105-1 278 182-1 279 060 Mowing machines ; 1 278 181 Rake ; 1 278 644 Maize harvester ; 1 279 870 Steering device for harvesting machine ; 1 279 995 Fruit ladder and conveyor.

MACHINES FOR LIFTING ROOT CROPS. — *Denmark* : 23 525 Device for potato digger

Sweden : 43 773 Root topping machine ; 43 855 Beet digging machine ; 44 017 Potato and root digger.

United States : 1 276 903-1 279 502-1 279 793 Potato diggers

THRESHING AND WINNOWER MACHINES. — *Canada* : 185 365-185 791 Grain cleaning machines ; 185 393 Thresher.

United States : 1 279 308 Cereal grain hulling system.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada* : 185 403-185 730 Grain picklers ; 185 658 Hay stacking machine.

Switzerland 79 442 Recipient with press for sweet green fodder ; 79 598 Device for presses.

United Kingdom : 118 936 Baling press.

United States : 1 276 986-1 278 301 Baling presses ; 1 277 306 Wire spacing attachment for baling presses ; 1 277 666 Hay loader ; 1 279 736 Hay stacker ; 1 279 938 Silage packer.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada* : 185 543 Tractor wheel ; 185 586 Tractor for farming.

United Kingdom : 118 909 Draught attachment for a plough , 119 071 Tractor

United States : 1 276 929-1 276 949-1 278 256-1 278 452-1 278 498-1 278 650-1 279 030-1 279 479 Tractors ; 1 277 181 Wind motor , 1 277 740 Means for steering and controlling motor tractors, motorploughs, etc. ; 1 278 030 Shock absorber ; 1 278 328 Transmission casing for tractors ; 1 278 759-1 279 070 Tractor attachments ; 1 279 619 Caterpillar tractor (attachment).

FEEDING AND HOUSING LIVESTOCK. — *Switzerland* : 79 599 Device for cleaning cattle.

United States : 1 276 946 Automatic calf feeder ; 1 276 972 Animal oiling device ; 1 279 503 Calf weaner.

POULTRY FARMING. — *Canada* : 185 372 Egg crate.

United Kingdom : 118 816 Egg box.

United States : 1 277 530 Egg turning device for incubators ; 1 278 248 Egg holder.

APICULTURE. — *Spain* : 67 381 Improvement to the hive sections.
Sweden : 44052 Hive frame section.

United States : 1277451 Honey extractor.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada* : 185 738 Dough mixer.

Netherlands : 2 593 Process for making strawberry preserves.

Spain : 67 284 Mill ; 67 417 Process for extracting potash salts from kernels ; 67 490 Process for making flour from ripe bananas.

United Kingdom 118 115 Mill for grinding grain ; 118 535 Soya bean milk ; 119052 Flavouring material for butter substitutes.

United States : 1 276 988 Fruit drier ; 1 277 185 Process for preparing and extracting vegetable fibre from Yucca, etc. ; 1 278 547 Fruit cleaner, dipper and grader ; 1 279 134 Sugar mill ; 1 279 309 Nut-cracking machine.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *United Kingdom* : 119 007 Egg preparations.

United States : 1 277 776 Tannery waste disposal process.

DAIRYING — *Canada* : 185 743 Alcohol production from whey.

New Zealand : 38 937 Curd mill ; 39 121 Apparatus for extracting germs from milk

Sweden 43 776 Installation of milking machinery ; 43 933 Pulsator for suction milking machine ; 43 988 Churn.

Switzerland : 79 483 Churn ; 79 643 Cheese keeping process

United Kingdom : 118 486 Machine for filling bottles, cans, etc. ; 118 535 Soya-bean milk ; 118 742 Milk can, 118 874 Food preparation of whey ; 119 052 Flavouring material for butter substitutes.

United States : 1 276 897 Bottle washing machine ; 127 8562 Milk Warmer ; 1 279 288 Milk bottle and cap.

FARM BUILDINGS AND EQUIPMENT — *United States* 1 277 305 Wire stretcher.

VARIOUS. — *Canada* : 185 442 Pump.

105 — **Mechanical Pressure Silos.** — SAVARANI, G. in the *Rivista d'Agricoltura* Year XXIV, No. 42, pp. 334-336 Parma, October 18, 1918

These silos, devised by Dr. SAVARANI, Director of the "R. Stazione sperimentale di batteriologia agraria" of Crema, Italy, have the shape of long tubes with an octagonal base and conical cover. The frame-work is made of iron or wood, carefully joined so as to prevent completely the entrance of air. Between the walls slides a strong cover, raised by tackle-ropes or a windlass and metal cables. The object of the cover is to convey to the forage below the pressure exercised by a large screw and an arrangement similar to that of the MABILET press. Near Crema, province of Mantua, have been built several of these silos, some large enough to hold 196 tons of green fodder. A form for small farms is also built and holds about 10 tons of fodder.

In green fodder thus compressed there is abundant emission of carbonic acid produced by the respiration of the plants. The escape of this gas is prevented by the hermetically closed cover and is retained almost entirely

by the fodder, preventing its vital functions and, consequently, heating. The fodder, therefore, undergoes very slow and limited changes, the proteins are not appreciably modified, and the sugar is changed partly into acetic acid and partly into lactic acid, which has an anti-putrifying action. One hundred tons of grass yield about 18 to 20 tons of ordinary dry hay, whereas with the pressure system, 80 tons of ensilage are obtained. As the daily ration of an adult ox is about 40 lb. of hay and 77 to 88 lb. of ensilage, the same amount of grass will give a double number of rations if it be ensiled in this manner instead of being made into hay.

The author examined a sample of fodder ensiled under pressure and found it excellent, perfectly preserved, of a fine green colour, the flowers almost of their natural colour, soft to the touch, and of a characteristic light and pleasant odour. He foretells the general adoption of this system, especially on small and medium-sized farms.

AGRICULTURAL INDUSTRIES.

106 - **A Method for De-foxying Wine** (1). — CARLYS DE CARBONNIÈRE, F., in *Le Progrès agricole et viticole*, Year XXXV, No. 45, pp. 443-444 Montpellier November 10, 1918.

The author reports an experiment he made to remove the foxy taste from wine made from 4132 Seibel. The experiment was successful and the wine lost completely its slightly foxy flavour. The experiment was made on a small scale only and it would be interesting to repeat it with a large quantity of wine, especially that made from Noah, which has a much more marked foxy flavour than the one that was actually used.

The method consists in pulverising the must from time to time before fermentation. It seems similar to the method of M. TISSFRAND by which a hole is drilled in the bottom of the fermentation cask (2). Certain wine-makers, including M. RAVAZ laughed a little at this method, yet its effect is very easily explained. In a recipient having but one bung-hole the carbonic acid produced by the fermentation accumulates and the must is no longer in contact with the oxygen of the air. If, however, there is another hole at the level of the liquid, the carbonic acid escapes through it, the air is continually renewed and impregnates the particles of must raised by the bubbles of gas which break on the surface. Pulverisation renders oxidation more complete, and it might prove excellent to combine the two methods pulverisation of the must and aerated fermentation.

During his experiment the author noticed that, whereas in still must, the impurities are deposited at the bottom of the cask more or less slowly, according to their density and state of division, in pulverised must they rise very rapidly to the surface in the form of coagulated froth. This might furnish a method of clarifying, for white wines at least.

(1) See R May, 1916, No. 555; Feb., 1917, No. 183; June, 1918, No. 684; Dec., 1918, No. 1407. (Ed.)

(2) See R Feb 1917 No. 183 (Ed.)

107 - **Press-drainer for Grapes.** — MAHOUX, J., in *Le Progrès agricole et viticole*, Year XXXV, No. 46, pp. 466-468, Montpellier, November 17, 1918.

The author (Professor of Agriculture at Castelnaudary, Aude) describes a new press-drainer, made by M. PERA, of Florensac, Hérault, which makes it possible to separate very rapidly most of the must from the solid parts of the grape and to send directly to the press residue already drained to a large extent. The grapes are carried from the cellar floor to the press-drainer by receptacles on a slanting chain. The juice goes immediately into a clarifying basin under the flooring. The residue crushed and already slightly pressed by the passage through the press-drainer, passes, through a slide on to one of the two presses (MARMONNIER "Auto-Déclic") placed on the floor above the press-drainer.

During the vintage of the autumn of 1918 M. MIR made two series of tests to determine the effects of a press-drainer on a day's vintage. The yields obtained were very high. On October 21, 23 713 lb. of grapes yielded 1 540 galls. of must from the clarifying basin, 418.17 from the 1st press, and 66 33 galls from the 2nd press, or 2 024 5 galls of must altogether. One hundred pounds of grapes, therefore gave 5 9 galls., 2 0 galls., and 0.2 galls. respectively, giving a total of 8.1 galls.

If the ripeness of the fruit be considered (the density of the must rose to 1.075) and the fact that owing to drought, the grapes were not very juicy that year, it is seen that the yield in must obtained with the press-drainer was perfectly satisfactory. Taking into account the inevitable losses due to fermentation, about 11 lb. of grapes yield 1 gall. of wine.

On the last day of the vintage, October 25, 22 416 lb. of grapes were brought in, they yielded 1 408 galls. from the clarifying basin, 308 galls. from the 1st press and 47 3 galls. from the 2nd press, i. e. a total of 1 763.3 galls. of must. One hundred pounds of grapes, therefore, yielded respectively 5 7 galls., 1 2 galls., and 0.1 galls., a total of 7.0 galls. This yield of 7 galls. per 100 lb. of grapes is a little lower because the density had passed from 1.075 to 1.079 (the grapes were riper and less juicy). One gallon of wine was obtained from about 13 lb. of grapes.

The advantage of the press-drainer does not lie solely in the high proportion of must extracted. The large quantity of must separated from the stalk by the passage through the apparatus (65.08 % in the experiment of October 21, and 62.94 % in that of October 25) must also be considered. The results should be considered particularly when injured fruit is used or white wine made from black grapes, as the period of contact between the solid parts and the must is much shorter than when draining rooms are used. Moreover, the grapes brought to the press have already been slightly crushed and take up much less space than those crushed in the ordinary way. Fewer pressings for the same quantity of fruit are necessary, and involve a saving of labour. Pressing is also more rapid when the fruit has already drained. This is a further advantage, especially in the case of injured grapes with black skins used for making white wine. The apparatus is strongly recommended for use wherever white wine is made.

108 - **Alcohol from White Asphodel.** — I. PANTANELLI, E., Utilizzazione del porrazzo per la fabbricazione dell'alcool, in *Stazioni sperimentali agrarie italiane*, Vol. VI, Pt. 3-6 pp. 85-102, Modena, 1918. — II. MONACO, E., L'alcool d'asfodelo come combustibile nazionale, in the *Annali d'Ingegneria e d'Architettura*, Year XXXIII, No. 8, pp. 113-120, Rome, April 16, 1918.

I. - UTILISATION OF THE ASPHODEL FOR THE MANUFACTURE OF ALCOHOL.

— In Italy the name "porrazzo" or "asfodelo" is given to different species of *Asphodelus* growing in the country, the most common of which is *A. ramosus* of central, south and insular Italy. In Araby an excellent gum is extracted from the tuberous roots of the asphodel, the floral stems are used as fuel and material for straps, in times of famine the leaves are eaten by animals, and the tubers form good food for cattle, goats, asses and pigs, boiled, then fried or roasted and seasoned they make an appetising dish. The plant also has well-known medical properties, especially diuretic. The industrial utilisation of this plant should, however, be for the production of alcohol and paper pulp.

The history of the manufacture of alcohol from asphodel is rapidly reviewed. Started towards 1850, it was attempted in Algeria, France, Italy, Spain, and Greece, but never became a permanent industry. A description is given of the development of the plant and its chemical composition. The tuberous roots of *Asphodelus ramosus* contain no starch but are rich in other carbohydrates amongst which sugars predominate. There is also much of a colloidal carbohydrate a mucus soluble in boiling water and largely convertible into sugar, and a little pectic substance partly convertible into sugar. The total yield in sugar varies from 14 % (December) to 22 % (August). The best season for harvesting is that of flowering (May to June), because the sugar content is then highest and the colloid content lowest. One-year roots contain more sugar and less colloids than two-year ones. When the roots are gathered the sugars decrease as a result of respiration and condensation to colloidal carbohydrates difficult to convert into sugar. Similar condensation occurs if the tubers are dried at 100°C. for making meal or slices.

The roots should, therefore, be used fresh, as soon as they are gathered, or their composition will vary unfavourably. From 1 cwt. of fresh asphodel roots, gathered in a good season and carefully treated, may be obtained by fermentation 9 lb. of ethyl alcohol. In practice a yield of 7 % in weight or 8 % in volume should be calculated for; this is a satisfactory yield for a distillery in a district where asphodels are plentiful. The asphodel is easy to grow, but at present advantage should be taken of the enormous quantities of this plant which grow wild, from the coast to the mountain, in central and southern Italy.

II. - - ALCOHOL FROM ASPHODELS AS FUEL IN ITALY. — The author calls to mind the unsuccessful attempts made in France and Italy to develop the industry of alcohol-making from asphodels. These failures were due chiefly to the difficulty of freeing alcohol from its bad taste and also to the faulty fermentation methods adopted. Under present conditions it would be advantageous to utilise the tuberous roots of asphodel for distillation.

In Italy this plant renders unproductive thousands of acres which it invades. It is capable of producing 160 cwt. of roots per acre which, with a yield in alcohol of 6 % only, could yield 107 galls. A description is given of the distillation method used by the contrabandists of the province of Lecce (washing, cutting, maceration in warm water, acidification with sulphuric acid, addition of beer yeast, fermentation, distillation), which does not correspond with that used in ordinary factories (pressure of the tuberous roots, addition to the residue of 25 % of warm water and re-newed pressure ; the two liquids combined represent 80 to 85 % of the weight of the roots and contain 14 to 15 % of fermentable substances ; acidification with sulphuric acid and boiling, which greatly increases the amount of substances convertible into alcohol ; fermentation with beer yeast, distillation).

As the chemical composition of the asphodel root (which contains 70 % of moisture and 30 % of dry matter) closely resembles that of the Jerusalem artichoke, it could probably be distilled by the same method. By using modern, improved methods of distillation it would be possible to utilise 90 % of the substances convertible into alcohol which it contains.

109 - Utilisation of *Arum italicum* for Food and the Manufacture of Starch, Glucose and Alcohol. — See No. 12 of this *Review*

110 - Inversion of Cane Sugar by Colloidal Silica. — MARY, ALBERT and MARY, ALEXANDRE, in the *Comptes rendus de l'Académie des Sciences*, Vol. 167 No. 18 pp. 644-646 + 1 Table Paris, 1918

Results of experiments on the inversion of cane sugar by the aid of colloidal silica, prepared with sodium silicate and hydrochloric acid. The work included 3 series of experiments: — a first series with dialysed hydrosols (at 8 %, 5 % and 1.5 % and at ordinary temperature 15-20°C); a second and third series with undialysed hydrosols (so as to remain under conditions of physical instability similar to those of cellular colloids).

CONCLUSIONS. — Colloidal silica, like mineral acids, acetic acid, invertase and the hydrosols of palladium, gold and platinum, appreciably inverts cane sugar. Its inverting power is a function of its micellar state of dispersion and it is inactivated by physico-chemical circumstances which destroy the disperse phase of its pseudo-solutions. Under certain conditions of physical instability its activity increases with the temperature up to a variable optimum point, below 100°C (as is the case with "metallic ferments") and then decreases until completely inactivated. There is, therefore, a coincidence between the progressive inactivation and the progressive coagulation, which suggests the hypothesis that it is solely a case of the influence of heat on the degree of dispersion of the colloidal solution. This hypothesis also provides a satisfactory explanation of the thermic working conditions of diastases.

111 - Grain-Dust Explosions in Mills and Elevators in the United States. — DEDRICK, B. W. (Instructor in Milling Engineering) and FEHR, R. B. (Assistant Professor of Mechanical Engineering, Pennsylvania State College) in collaboration with PRICE, D. J. (Engineer in Charge, Grain-Dust Explosion Investigations, Bureau of Chemistry, Department of Agriculture) in the *U. S. Department of Agriculture, Bulletin* No. 681, 54 pp. + 17 Tables + 5 Figs. + 1 Plates + Bibliography of 30 Publications. Washington, May 18, 1918.

In addition to investigations into the inflammability of dust in separators (1), the Bureau of Chemistry of the U. S. Department of Agriculture undertook, in collaboration with the Pennsylvania State College, studies on the causes of the ignition of dust in mills and elevators, with a view to finding means of preventing the numerous losses by fire occurring of recent years in such buildings. An experimental mill was installed in 1915 by the Department of Mechanical Engineering of the Pennsylvania State College. The building erected for the experimental grain was 15 × 15 × 24 ft., and made of a light frame covered with ridged galvanised iron. An attrition mill, two elevators, a dump bin, a stock hopper over the mill, and a small bin for receiving ground material were installed. This apparatus was placed on a raised platform 14 in. high. A screw conveyor 10 ft. long was placed 2 ft. below the floor to carry the material from the mill to the elevator or dust room, built on to the main building. The attrition mill, screw conveyor and elevator were drive by a 15 H. P., direct-current motor in the basement. Peepholes were made through which to observe the origin and duration of the sparks.

Preliminary experiments were made to determine whether, during milling explosions may be caused by, 1) sparks emitted by foreign material (nails, flint, matches, etc.), 2) a naked flame. In the first case the results were negative in the second, positive. A series of sixteen experiments was then made with grain, sprouts, brewers' dried grain, etc. The final conclusions of these experiments, described at length and summarised in tables, are:

1) Precautions for collecting and removing the dust in the mill and surrounding atmosphere are indispensable

2) In some cases it may be advisable to use inert gases to decrease the oxygen content and thus prevent the formation of an explosive mixture of air and dust

3) Wherever there is danger of a dust-laden atmosphere every possible source of heat should be eliminated.

4) Every precaution should be taken to eliminate sparks caused by static electricity.

5) Greater use should be made of sheet iron on account of the very great danger from smouldering heaps of grain

6) Revolving dampers, such as used in the experiment and in some mills, appear useful for the prevention of the propagation of explosions.

7) The principle of the automatic relief valve should receive more attention as a means of partially preventing the propagation of the flame.

(1) See *R. M. E.*, 1915, No. 536, and *R. Nov.*, 1916, No. 1208 (*Ed.*)

The aim of the relief valve, placed in a gas relief pipe, one end of which is in the hopper, the other outside the building, is to relieve automatically the pressure caused by an explosion and to help to prevent the flame from spreading to a dangerous part of the mill. The experiments showed the value of this arrangement.

112 **The Hydrogenation of Ground-Nut Oil.** — HEIM, F., JOB, A. and STURZWAGE, H. in the *Bulletin de l'Office Colonial*, Yeu XI, Nos. 17-128, pp. 355-361 + 1 Diagram Melun (France), July-August, 1918

Work carried out in the "Laboratoire de Phytotechnie" and in the chemical laboratory of the "Conservatoire national des Arts-et-Métiers", at Paris.

Fats as is known, consist of glycerides or glyceric ethers of fats, and melt at a temperature which is all the higher the less unsaturated acids they contain. The unsaturated acids are saturated by catalytic hydrogenation; in this even the glycerides are saturated which then remain solid at ordinary temperatures.

Except drying oils, oleic acid, $C_{18}H_{34}O_2$ is the only unsaturated acid usually contained by fats. On adding 2 atoms of hydrogen to this oleic acid, liquid at ordinary temperatures, it is transformed into saturated stearic acid, $C_{18}H_{36}O_2$, melting at $70^{\circ}C$. The melting point of the fat after hydrogenation is all the higher the more stearic acid it contains.

The hydrogenation of fats also diminishes their iodine index (index expressing the amount of iodine taken up by 100 parts of the fatty body).

The elevation of the melting point becomes of great commercial and industrial interest, if the operation can be carried out sufficiently economically. Generally speaking, fats are all the more valuable the less easily they melt. Thus the new industry of the hydrogenation of fats has begun to develop.

Hydrogenated fats are chiefly used in soap-making in admixture with other fats in order to obtain hard fats. Hardened fats do not seem to have been used in the stearin industry, as the interest of the operation depending on the cost of stearic acid and the transformation have to be integral to be advantageous.

The use of hardened fats is under consideration for food by replacing butter and its substitutes (margarine, vegetable butters), theoretically, it is feared that traces of the substances used to obtain the hydrogenation remain in the product.

The authors describe a hydrogenation process using reduced nickel as a catalyst, the reducible nickel salt used is the formiate $(HCO_2)_2Ni \cdot 1\frac{1}{2}H_2O$.

Hydrogenated ground nut oil is a hard white fat like wax, without taste or smell. Its characteristics are: — iodine index, 13.5; solidifying point, $47.8^{\circ}C$; melting point, $58^{\circ}C$. (the initial iodine index is 81.9; the solidifying point of the oil is near $2^{\circ}C$).

Considering that the melting point of beef fat is about 46° , and that of mutton fat (the hardest of the ordinary fats) is not over $52^{\circ}C$., it will be seen that it is possible, by grading the hydrogenation of ground-nut oil as

may be desired, fats as hard as and even harder than the most appreciated animal fats may be obtained.

- 113 - Contribution to the Chemical, Study of the Fruit of *Camellia drupifera* Lour. and Camelia Oil. — BOUVFLOT, in the *Bulletin économique de l'Indochine*, Year XXI, No 129, pp 232-234 Hanoi H Iphong, March April 1918

The oil obtained by simple extraction in the cold of *Camellia drupifera* is clear after filtration, very transparent, golden yellow, of a sweet and pleasant flavour and a peculiar, not over-strong odour. The results are given of a physical-chemical study of this oil and an analysis of the cake and the seed.

Freed from the little saponin it contains, camelia oil would make an excellent table oil of a sweet and pleasant flavour. Well prepared it would be free from the glucoside which deprives it of its value as a food. This value is increased by the resistance of the oil to rancidity. Camelia oil would be suitable for soap-making. Its low content in solid fatty acids makes it of no value in the preparation of stearin. On the whole it is a non-siccative oil.

The cake could be used advantageously as a fertiliser. In addition to its fertilising properties, the saponin it contains is toxic to insect larvae and would prevent their development. Throughout the Thauh-Ba district the cake is used for fishing in stagnant water. The saponin is a protoplasmic poison with hydrolysing properties

The nuts, i. e. the seed, contain 50.34 % of shell and 49.66 % of kernel. One hundred kernels weigh 199.55 gm. The kernel yields 47.84 % of oil, or 23.75 % of the whole nut.

- 114 - A Substitute for Linseed Oil: "Benefing" Oil — *L'Esporteur français*, No 92, p 35 and No 96, p 31 Paris, May 2 and 30, 1918. Reprinted in the *Bulletin de l'Office Colonial*, Year XI, No 126, p 345 and Nos 127-128, p 370 Melun France, June and July August, 1918.

Under the direction of Governor PÉRIQUET and M. VUILLET, Director of Agriculture of the Upper Senegal and Niger, very important experiments have been made with a view to substituting products produced locally for those imported from France. In the work-shops of the Kayes railway, in the Niger district, "benefing" seed was treated and a siccative oil obtained which satisfactorily replaces linseed oil and is used in all the workshops of the railway. Unfortunately the extraction, carried out by inappropriate methods, gives but a low yield (about 7 galls per 1000 lb.). This proof that "benefing" oil can advantageously replace linseed oil for industrial purposes is, however, of great value under present conditions.

"Benefing" is also found in Madagascar, especially in the north-west of the island, from Sombirano to Anolobe, where recent decomposition of basalt has formed a deep humus, rich in iron. The plant grows wild. The Sakalaves call it "voa matavy" or "voa mamy" and, without tending it particularly or even taking the trouble to reproduce it regularly or extend its cultivation, thoroughly understand its food value.

- 115 - Utilisation of Rice Straw.**—NICOLA, I, C, in *Gazzetta agraria commerciale e industriale, Organo del Consorzio per le Cattedre ambulanti di Agricoltura per la Provincia di Alessandria*, Year II, No 18, pp 195-196 Alessandria, September 30, 1918

Even on estates in Italy devoted especially to rice-growing, rice straw, up to the beginning of the war, was regarded almost an encumbrance. Litter was made by preference with wheat or oat straw, and only when all other cereals were exhausted was recourse had to rice. As rice is harvested while its culms are still almost green, the straw, after threshing, undergoes active fermentation, followed by putrefaction, which destroys a large part of it. If this straw is used as litter it gives, when moved, a disagreeable dust, caused by the mouldiness. If fed to animals it would cause serious trouble of the digestive and respiratory organs. In other cases the rice straw is, after threshing, spread in the courtyards, on the paths, and especially along that leading from the stable to the drinking trough. It does not decompose for a long time, keeps the surface of the soil continually moist, and sometimes causes the formation of a layer of mud full of pathogenic micro-organisms and, consequently, dangerous to animals, which easily contract bad feet and sometimes "zoppina lombarda" (lameness).

Rice straw must, therefore, be dried. Dried and baled rice straw fetched, in Italy in 1918, 4s. 6d per cwt, and is being used increasingly for various purposes. Some rope-walks use it for making ropes.

The maturation of rice straw is a very simple process. The straw from the thresher is put on small carts and carried to a clear, clean space, where it is spread out thinly and left for two days. On the third day it is turned, and, at the end of the same day, if the sun has shone continually, it is dry and ready to be made into bundles or, better still, pressed. The straw then undergoes moderate fermentation which completes maturation. It does not putrefy and turns a fine golden-yellow.

- 116 - The Utilisation of Rice and its By products in Different Industries** - See No 8 of this *Review*

- 117 - The Foundation of an Industry Utilising the Fibres of the Banana with Edible Fruit, in Spain.**—*Revista de la Cámara agrícola balear*, Year XX, No 19, p 146 Palma de Mallorca, October 10, 1918

Sen. T. ROCA, of Las Palmas, Majorca (Balearic Isles), has registered a patent method for utilising the fibres of the banana with edible fruits for making textile fabrics, thread, ropes, sail cloth and rope soles, so as to replace abaca or Manila hemp (*Musa textilis*) and hemp.

The fibres extracted from the banana are of very good quality; the finest are like "nippis" (1) and are used for making textile fabrics, the medium ones are used for making ropes, especially ship's cables, while the coarse ones are used for making sacks. The plant for the manufactory to be established at Las Palmas has been shipped from the United States.

(1) Fibre from the Philippines and Madagascar is obtained from the genera *Musa* and *Canna* (Ed.).

118 - New Method of Estimating Caffeine in Coffee. — VAUTIER, E., in *Annales de Chimie Analytique*, Vol XXIII, No 10, pp. 207-210 + 1 Table, Paris, 1918.

The present shortage of chloroform induced the author to attempt to find a method for estimating caffeine without chloroform. He mentions the chief methods adopted which use as a solvent of caffeine, either chloroform (KELLER-SIEDLER, *Manuel suisse des denrées alimentaires*, 2nd French edition, p. 164; PHILIPPE, *Ibid.*, 3rd German edition, p. 192), or carbon tetrachloride (LENDRICH-NOTTBOHM, *Zeitschrift für Unters. Nahr.-und Genussmittel*, 1909, p. 241). He then describes his own method.

The finely ground coffee (5 gm.) is placed in a roll of filter paper closed at both ends with cotton-wool and placed in a Soxhlet apparatus with about 5cc. of ammonia. Ether is added, the mixture extracted for 4 hours then, the caffeine having passed into the solvent, the ether is distilled over the hot water bath, and the residue treated with boiling water. This is filtered, washed with hot water and evaporated to dryness.

A series of comparative data is given showing the efficacy of this method which gives figures very near to those obtained by PHILIPPE's method.

119 - Study and Determination of the Industrial Value of a Gum of the North Cameroons. — HEIM, F., in the *Bulletin de l'Office Colonial* Year XI, Nos. 127-128, pp. 361-366. Melun, France, July-August, 1918.

The Service for the Study of Colonial Production received from the North Cameroons samples of a gum. These were examined and the author (Director of the Service) gives the results obtained.

Some of the samples were in bars, others in fairly large lumps. In spite of their different shapes they appeared identical. Whether it be in bars or lumps the material, when cold, is pink inside, the darker colour on the surface being certainly due to oxidation. Hard at normal temperature the product, when touched gives the impression of rubber and is elastic. When heated dark red or black particles separate and appear to form a rubbery substance.

The product appears to be intermediate to gutta-percha and rubber. Its density is between 1 and 1.01. It softens at about 40°C. In the crude state, but more particularly when purified, it is very suitable for making all kinds of moulded articles used in chemistry, surgery, dental work, etc., and very fine galvano-plastic moulds may be obtained with it. Less hard than rubber, it has a slight elasticity which light vulcanisation would render permanent. Only the purified gum vulcanises and may thus be hardened and made invulnerable to physical and chemical agents. Considering the great resistance of this gum, intermediate to that of rubber and gutta-percha, it could be used as isolating material for cables. If not a true gutta-percha, it is at least a valuable gum.

120 - New Method of Analysing Butter. — ERGULISSE, P. and DACKWEILER, H., in *Annales de Chimie Analytique*, Year XXIII, No 11, pp. 225-234. Paris, November, 1918.

To make the value of a new method for the chemical analysis of fats especially butter, better understood, the chemical composition of fats is

summarised. Fats are tri-glycerides, i. e. ether salts of glycerine and mono-basic acids of the aliphatic group, the chief of which, in fats used for food, are butyric, caproic, caprylic, caprinic, lauric, myristic, hypogaecic, palmitic, stearic, oleic, arachidic, erucic acids, etc. The natural fats differ: 1) in the different proportion of fatty acids; 2) in isomerism. Chemical analysis can show only the nature and, at the most, the proportion of the various fatty acids, whereas isometric determination of the differences depends on purely physical methods (density, refractive index, critical temperature, etc.).

The authors review briefly the chemical methods now in use which they propose to modify. They are: — 1) Determination of the saponification index (KOETTSTORFER's index); 2) the determination of the soluble volatile fatty acids (REICHERT-MEISSL-WOLLNY index); 3) determination of the insoluble volatile fatty acids (POLENSKE index); 4) determination of the fixed fatty acids (HEHNER index). All of these determinations are criticised and their insufficiency and lack of precision shown. The modifications proposed by several authors are then given: —

a) WYSSMANN and REYST method in which the REICHERT-MEISSL index is determined twice, the first time by distilling 100 cc., as in the usual method, the second by distilling 300 cc. for, if the fats contain much caproic and caprylic acids, these acids not only are not removed by distilling 100 cc., but this quantity of water does not suffice to dissolve all of these acids contained in the distillate. To dissolve all these acids at least 300 cc. must be distilled and 100 cc. of water for each additional 100 cc. of distillate to be collected added to the distillation residue of the REICHERT-MEISSL index. In each of these distillates the caproic and caprylic acids are estimated, taking as a basis the insolubility in water of their silver salt, whereas silver butyrate is soluble. The same result is thus obtained in the two estimations if the fat analysed contains few C_6 and C_8 acids as is the case in cow's butter, but not in coco butter which contains much caproic and caprylic acid.

b) Other analytical methods for fat have been proposed by JEAN and BELLIER, based on the solubility of salts of Mg, Pa, Cu, and Pb of the fatty acids of the glycerides. These methods, however, are not used in practical laboratory work.

The method recommended by the authors is based on principles similar to those used by WYSSMANN and REYST, and JEAN and BELLIER, but differs from these in the application of these principles. Its main conditions are: —

1) *Determination of the saponification index, I_S* ; the number of cc. of normal KOH or NaOH necessary to saponify 1 gm. of fat represents the number of milli-molecular grammes of fatty acids in this quantity.

2) *Determination of the silver index, I_{Ag}* , which consists in precipitating a known quantity of neutral soap by silver nitrate. Only the butyrate is not precipitated. By determining by titrating back the number of cc. of normal solution of $AgNO_3$ necessary to the precipitation of acids other than butyric acid and comparing this number with the soap obtained from

1 gm. of fat, is obtained the number of milli-molecular grammes of acids other than butyric acid in 1 gm. of fat. By subtracting this number from the IS number the IAg is obtained, i. e. *the number of milli-molecular grammes of butyric acid in 1 gm. of fat* (this number, multiplied by 5×10 to bring it to 5 gm. of fat and the number of decinormal cc. is the true REICHERT-MEISSL index).

3) *Determination of the magnesium index, IMg .* A fresh, known quantity of neutral soap is precipitated by magnesium sulphate. The filtrate contains only the salts of the fatty acids below C_{12} , the magnesium salts of which are soluble. By precipitation with normal silver nitrate is determined the number of milli-molecular grammes of acids below C_{12} other than butyric acid, i. e. IMg or *the number of milli-molecular grammes of caproic, caprylic and capric acids in 1 gm. of fat* (this number, multiplied by 5×10 , as in the preceding case, gives the equivalent to the POLENSKE index).

These three figures (IS , IAg , and IMg) make it possible to calculate the HEHNER index. IS makes it possible to estimate the weight of the glyceric residue in 1 gm. of fat. By subtracting this weight from 1 is obtained the total weight a of fatty acids in 1 gm. of fat. The molecular weight of butyric acid (88) $\times IAg$ gives the weight b of butyric acid in 1 gm. of fat. The average molecular weight of the three C_6 , C_8 and C_{10} acids (144) $\times IMg$ gives very approximately and with sufficient exactitude, the weight c of the C_6 , C_8 and C_{10} acids. The HEHNER index is, therefore $a - (b + c)$.

After a minute and detailed description of their method the authors point out its advantages (especially the precision of the silver and magnesium indices, superior to the REICHERT-MEISSL and other indices, and similar to that generally obtained in mineral chemistry). They also lay stress on the rapidity of the method which can be carried out in 2 hours. The method may be applied to the analysis of all fats and their derivatives.

121 - Deterioration of Eggs Considered from the Point of View of Sanitary Inspection.

- - MARTEL (Chief of the Sanitary Veterinary Service at the Prefecture of Police), in the *Revue Scientifique*, Year LXI, No. 17, pp. 532-533, Paris, 1918.

Candling in a dark room is the best method of testing eggs. The author's investigations led him to classify the spots reported by professional candlers. He shows that GERMAIN's hypothesis, that eggs with mobile spots are practically exempt from bacteria, is subject to exceptions.

Mobile spots usually show beneficial changes -- thick chalazas, foreign bodies, dark yolk, autolysis of the white with setting free of chalazas, embryo little developed.

Eggs with so-called "*red rot*" are distinguished by the presence of diffused shadows or cloudiness, and the contents are reddish showing the broken yolk to be mixed with the white (eggs rarely rich in bacteria, but attacked by mycelium where the yolk is in contact with the shell). On account of the very marked and often disagreeable smell and flavour of these eggs, they are refused by the consumer.

Long incubated eggs show the same characteristics as those with red rot.

In *very old eggs* the yolk adheres to the shell at a point diametrically

opposed to that on which they are resting ; turning the eggs sharply during candling prevents this adherence.

Mouldy eggs have spots, called " mouldy or damp ", which are always immobile and very obvious ; the centre of these spots turns black, sometimes red or violet (presence of chromogen bacteria). The large, fixed spot is observed especially in eggs on sale at the end of summer or in winter. Numerous damp spots are found especially in summer, in badly packed eggs or those sent by sea (Moroccan or Russian eggs). The ascomycetes most commonly found are *Aspergillus* and *Penicillium* (in the ratio of 3 : 1 in 114 hen's eggs studied by the author). Eggs showing when candled, concentric halos round the mould spot contain colonies of bacteria which can easily be distinguished from the moulds, even with the naked eye. Mouldy eggs often contain no bacteria. Eggs which have recently become mouldy may be used in biscuit-making, but mouldy eggs containing bacteria give off a disagreeable smell and are unfit for consumption.

Eggs with so-called "*black rot*" are often spotted eggs, the central black part of which has spread gradually till it has invaded the whole egg. All forms of putrefaction have not yet been described.

Badly frozen eggs (1) (faulty packing, insufficient freezing) usually show at first small, red spots of dampness which become large black spots and rapidly spoil the egg.

The putrefaction of eggs preserved in lime is easily distinguished. In addition to the characteristics of the shell (roughness, fragility, great porousness) the white of such eggs is very transparent. The yolk is also extremely mobile and appears, through the watery white, as a shadow of marked outline, and of a colour varying from tawny to sepia-black, according to the degree of putrefaction. The yolk of very bad or "*burnt*" eggs does not adhere to the shell, but when broken, gives off a disagreeable smell. The yolk is dark and liquefied, the white almost always reddish and rich in bacteria. Deterioration affecting the taste and colour are not shown by candling. Fresh eggs very slightly affected by bacteria during development have all the characters of healthy eggs.

These data, whilst showing the difficulties with which a service for the sanitary inspection of eggs has to contend prove that, in most cases, candling may be satisfactorily adopted.

122 - **Tunisian Wool.** — *Bulletin mensuel de l'Office du gouvernement tunisien*, Year XII, No 102, pp 151-153. Paris, July-August, 1918.

There are in Tunis 700 000 sheep, producing about 1 670 tons of wool annually. The local consumption is about 690 tons a year, leaving 980 for export. During the last ten years the average annual amount exported was 825 tons (442 to France) of greasy wool and 104 tons (75 to France) of washed wool. The data for these ten years show the annual exports to vary greatly (295 to 1 375 tons). These variations are due to : — 1) mortality, sometimes very high, as much as 40 % of all the flocks ; 2) foresight of the

(1) The air chamber of well frozen eggs is slightly enlarged. The yolk is not mobile, as in other eggs preserved for a long time. The white becomes reddish.

native breeder who keeps some of his wool from one year to another, sometimes for several years, and only sells it in small quantities according to his needs; 3) annual variations in the Tunisian weaving trade which is largely affected by good or bad years, not only in Tunis, but also in other North African exporting countries (Algeria, Morocco, Tripoli, Egypt). Four classes of wool are exported — skin wool, waste or "bou-kaddou", used mattress wool and sheared wool.

Skin wool from the slaughter houses or nomad flocks supplies 195 to 295 tons of these exports. The fibre is always removed with lime so that, as a rule, the wool contains much lime dust. Since a few years, however, some exporters wash them roughly, usually with sea water. This wool, before the war, sold at £2.16 s. to £3.12 s. a cwt., according to its condition and origin.

Waste or "bou-kaddous" is composed of waste from shearing, mostly from the lower parts, and is used by the Arab countrywomen as exchange money. It comes from all parts of Tunis without distinction, and chiefly from the town of Tunis and Sousse. This grade often contains a high proportion of dung and large impurities. Before the war it was worth £1.4s. to £2.0 s. per cwt. The annual amount available for exportation yearly is approximately 98 tons.

Used wool from old mattresses is little used in the native industry, and it is impossible to state the amount available each year as it varies greatly. It fetches from £1.16s. to £2.16s. per cwt. and is used by the importing countries principally for making felt.

Sheared wool, obtainable from the middle of March to the end of June or middle of July, supplies the most valuable and important part of the export, i. e. about 590 to 690 tons. A small part of the sheared wool is from thin-tailed sheep but most of it is from thick-tailed Barbary sheep. About 50 tons of wool is produced from thin-tailed sheep. This amount is increasing as a result of the good results obtained with these sheep from a point of view of reproduction as well as that of meat and wool. Before the war this wool cost £3 to £3.8s.; when thoroughly scoured the yield is from 32 to 38 %.

The wool from thick-tailed Barbary sheep may, from a point of view of quality, be divided into 7 groups, according to the producing district:—

1) Northern Tunis, the neighbourhood of the town of Tunis, Valley of the Medjerdah, Cape Bon; principal market, Tunis. Ordinary wool selling at £2 8s. to £2.16s. before the war. Yield when scoured, 38 to 44 %.

2) Certain centres of the same northern district, such as Beja, Iouk-el-Arba. Coarse wool worth £1.16s. to £2.16s.; 40 to 55 %.

3) Kef and Thala district; principal market, Ebba-Ksour. Strong wool, the fine and semi fine qualities are perfectly adapted to the making of cloths and hosiery; £2.12s. to £3.0s.; 35 to 45 %.

4) Kairouan, Sousse and Maktar district; principal market, Kairouan. Semi-fine wool used for carpets; £1.4s. to £1.16s.; 35 to 45 %.

5) Southern district within the circle of the railway Sfax-Gafsa-Sousse; principal markets, Sfax, Sidi-bon-Zid, Hadjeb-el-Aioun, Gafsa. Wool

fine, silky, elastic, suitable for fine cloths, but often full of sand; £2.0s. to £2.16s; 28 to 35 %.

6) Djerid district; principal market Tozeur. Same characteristics.

7) Gabès district and extreme south; principal markets, Gabès, Ben-Gardane, Medenine, Kebibi. Wool similar to the two preceding ones, but depreciated because of its very high content in sand; £1.8s to £2.4s; 20 to 30 %

123 - **The Action of Cold on Microorganisms.** — RUATA, G. Q., in the *Rivista del Freddo* Year IV, No. 4, pp. 120-126. Rome, April 10, 1913.

It is known that artificial cold does not destroy germs capable of damaging food stuffs, while it does paralyse their development by rendering them inert and harmless for as long as its action lasts. This is based on work done long since by MACKENDRIK, BROWN & ESCOMBE, THISTELTON-DYER, MACFADYEN, and others, which has shown that bacteria, and plants in general, resist low temperatures, not only those obtained with ordinary refrigerating machines but even those obtained with liquid air (— 190°C.) and liquid hydrogen (— 250°C.).

The author has long accepted this opinion, but he has often had the occasion, during his experience of the application of artificial cold to the cold-storage industry, of pointing out facts that are apparently in contradiction to the generally accepted theory. For this reason, he decided, towards the end of 1914, to carry out a series of experiments with the object of ascertaining whether, besides the suspension it is known to cause of microbial action, cold does not also produce a deeper or more directly germicidal modification.

Owing to the war the author could not extend his experiments as far as he would have liked, but the results he has so far obtained are already sufficiently conclusive. For the work a small AUDRIFFREN SINGRÜN (1) refrigerating machine was used, in which the temperature was constantly kept between —3° and —12°C. in a dry environment. The organisms under study were treated in this apparatus and their behaviour was studied both as regards the alteration of their biological properties as well as the final abolition of their vitality.

RESULTS. — 1) The researches on the vitality of *B. coli* showed that: — a) the action of cold retards the growth of the organism; b) the action is progressively germicidal, for the destruction of the culture begins to be apparent after 4 to 6 days and is complete in 115 to 120 days.

2) The researches on the biological properties of *B. coli* showed that cold, save some slight delays in development as compared with the controls, produced no modification.

3) Researches on the vitality and pigment formation of *B. pyocyaneus* showed: — a) that this organism, like *B. coli*, is progressively destroyed by the action of cold; b) that pigment formation is unaffected as it continues as long as traces of vitality remain.

(1) See R. Sept. 1918, No. 1029 (Ed.) and also *Monitore Tecnico*, 1916, No. 31. (Author)

4) Researches on the power of *B. pyocyaneus* to liquefy gelatine showed that the prolonged action of cold destroys this power. This organism, sown on an agar plate on December 17, 1914, was already destroyed on of March 12, 1915, while, inoculated in the thickness of the gelatine, it was still living on June 15, 1915.

5) Researches on the power of *Staphylococcus pyogenes aureus* to liquefy gelatine showed that, within the limits of time during which the exposure in the refrigerator lasted (from December 17 to various dates up to June 20), there was a notable and progressive delay in liquefaction, in comparison with controls under normal conditions, without, however, destroying the liquefying power.

6) The haemolytic power of the above organism was clearly reduced during the period of experiment (December 17, 1914 to June 20, 1915).

7) Cold destroys the liquefying power of *Bacillus proteus vulgaris*

8) No modification was noted, while the experiments continued (up to June 20, 1915) in the power of *B. proteus vulgaris* and *B. bulgaricus* to coagulate milk.

9) Researches on the amylolytic power of *Bacillus clavatus* Biffi showed that, under the prolonged action of cold this organism completely loses its amylolytic power, which is normally very vigorous.

10) The spores of *B. clavatus*, which are amongst the most resistant ones known, are clearly and gradually killed by the prolonged action of cold. The way the experiment was going suggested that, could it have been prolonged, the culture plate would have been completely sterilised.

11) The resistance of the cholera vibron to cold is very weak, while however, its agglutinability is unchanged.

12) The experiments on the vitality of *Bacillus fluorescens non liquefaciens*, *B. coliforme*, a liquefying *Streptococcus* that coagulates milk, *Bacillus prodigiosus*, *B. proteus vulgaris*, although more limited than the previous ones, confirm the germicidal action of cold in comparison with organisms other than those used in the work. These results are of great interest as regards organisms isolated from putrefying meat.

These results lead to the conclusion that cold produces more profound and definite effects on micro-organisms that has been so far admitted. The author intends to continue his experiments and hopes to arrive at conclusions of interest regarding the technique of the preservation of food stuffs in cold storage.

124 **The Influence of Cold Shock in the Sterilisation of Canned Foods.** — BUSHNELL, I. D., in *The Journal of Industrial and Engineering Chemistry*, Vol. X, No. 6, pp. 432-436 New York, June 1 1918

Thirteen experiments were made to determine the effect of different methods of sterilising tinned vegetables. The investigations included: — 1) the effect of heating to boiling point for 5 to 20 minutes and sudden cooling by immersion in iced water; 2) effect of intermittent heating followed by rapid cooling; 3) the necessity of complete sterilisation; 4) the result of hermetic closing. The vegetables used were peas, green beans, beets

and sweet corn. Control experiments were made with bacterial cultures from badly preserved foods.

CONCLUSIONS. — Blanching does not reduce the time required properly to prepare tinned foods. Small amounts of salt are of little value in preventing the development of bacteria in tinned foods. Small amounts of organic acid (acetic acid) have a distinctly retarding action on bacterial growth in tinned vegetables. The use of small quantities of acid is advisable wherever it will not injure the texture, flavour, or appearance of the product. In many cases an unsterile product will keep indefinitely if properly sealed. This, however, is not true in all cases, and sealing should not be relied on to take the place of proper sterilisation on account of the danger of loss through spore-forming anaerobes.

125 - The Commercial Freezing and Storing of Fish. — CLARK, E. D., ALMY, L. H. and PENNINGTON, M. E., in the *U. S. Department of Agriculture, Bulletin No. 635*, 9 pp. + 8 Figs. Washington, March 9, 1918.

The commercial method of freezing and storing fish as at present adopted and its effect on the fish are considered. Freezing and storage will keep fish in the condition in which it is received for several months, but will not remedy deterioration due to previous heating or bad handling. Only fish in perfect condition should, therefore, be accepted by freezers. Unless delivered 3 or 4 hours after being taken from the water, fish should be kept in ice in the boats. In many freezing plants it is necessary, to obtain a good product, to freeze rapidly at as low a temperature possible and store the fish as soon as it arrives. Freezing, by enclosing the fish in a coat of ice, prevents loss of moisture, protects the fish from moulds and bacteria, and makes it less subject to mechanical injury. Fish to be stored for more than 3 to 5 months should be re-frozen occasionally, as in time the ice evaporates, even at low temperatures. The most economical temperature at which to store fish is probably a constant one of from 0° to 15° F., although some freezers maintain that lower temperatures help to delay evaporation of the ice coating. Packing the fish in boxes before storage helps to prevent loss of the coating and protects it from mechanical injury. Properly frozen fish reaches the retailer in excellent condition; it should be kept frozen till sold. Thawing fish by warming or soaking greatly lessens its food value and flavour. Chemical analyses showed no appreciable change in fish stored 27 months, i. e. much longer than would be necessary or profitable in storing it commercially.

126 - Variations in the Loss of Weight and Deterioration in "Grosse Grise" Pears during Storage. — TRUELLE, A., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 37, pp. 1012-1021. Paris, November 27, 1918.

The author made experiments with pears of the "Grosse Grise" variety to determine the loss in weight and deterioration they undergo during storage. Twenty-two pounds of sound pears were divided into five lots of 4.4 lb. to see whether the volume or weight of the fruit had any appreciable effect on loss or the conditions of the fruit. The number of fruits in each lot varied from 14 to 20.

Loss in weight. - I. -- The loss in weight in "Grosse Grise" pears is fairly regular, according to the three periods of storage considered — normal, critical, extreme — and the volume of the fruit.

II. -- Loss of weight is greatest in the first of the three intervals of 15 days which form the normal and critical periods of storage. This confirms experimentally the advice given by fruit growers to dry the fruit for about 10 days before storing it. Loss of weight then progresses slowly and is very slight during the first 15 days of the extreme period of storage, which begins with the 60th day. It then increases suddenly, becoming $1\frac{1}{2}$ times greater than the average loss at the beginning of preservation.

III. -- Loss in weight seems less marked in small than in large pears, at the beginning of storage at least.

IV. -- The average loss of weight for each 15 days of storage, estimated from a mixture of pears of all sizes and compared with the total weight of fruit experimented with, was: - 1st 15 days, $\frac{1}{16}$; 2nd 15 days, $\frac{1}{9}$; 3rd 15 days, $\frac{1}{6}$; 4th 15 days, $\frac{1}{5}$; 5th 15 days, between $\frac{9}{20}$ and $\frac{13}{25}$.

Deterioration. - V. -- During the first 15 days of storage the pears suffered no visible deterioration. Only during the second 15 days did small, brownish spots begin to appear in 1 to 3 pears, according to the lots. Sleepiness was observed only in the third 15 days, affecting 1 to 2 pears in each lot to a more or less marked degree. During the fourth 15 days, sleepiness took on such a mixed form that it was difficult, because of the condition of the flesh, to distinguish between sleepiness and white rot, it being possible, after the 60th day, to confuse one with the other.

VI. - If these experiments are considered from the double point of view of the use of the pears for commercial purposes or for making perry, it is found that: 1) both from a point of view of loss of weight and deterioration it is to the interest of the grower to sell the fruit during the first 15 days after gathering and he should by no means keep them beyond the second 15 days of the normal period; 2) to obtain the maximum yield and best quality, pears should be made into perry during the second or third 15 days. Later than this, although the fruit has lost all commercial value and almost all its goodness for this purpose, it may be made into perry for distillation purposes, not for consumption.

127 - Samarani Silo for Small and Medium-sized Farms. — See No. 105 of this Review.

128 - Butter and Cheese Trade by Parcel Post, in the United States. LOHR, I. B., and POTTS, R. C., in the U. S. Department of Agriculture, *Farmer's Bulletin* 930, 12 pp. + 6 Figs. Washington, 1918.

Experiments were made with the sending of more than 2000 lb. of butter by posts in parcels of 2, 3, 5, and 10 lb. to the U. S. Department of Agriculture, Bureau of Markets by four dairies, in order to control the possibility of sending butter by parcel post. Of the 222 parcels sent between April and October by one dairy 375 miles from Washington, 218 arrived in satisfactory condition. In July and August only 1 parcel out of 61 was received in bad condition from a dairy 536 miles from Washington. In June and July, 73 out of 82 parcels from a dairy 187 miles away arrived in

good condition. The fourth dairy, 205 miles away sent 89 parcels between April and January, all of which arrived in good condition. These good results are attributed to the care with which the butter was packed and the careful freezing of the butter before posting.

The packets of butter received by the Department were sent to experiment stations which again returned them to the Department, where they arrived in satisfactory condition when the heat and distance were not too great. These experiments show that well-made butter carefully frozen before sending and suitably packed, may be satisfactorily sent by post when the heat is not too great. Even when all possible care was taken, butter posted during the warmest weather arrived almost melted and in bad conditions. Directions are given briefly for the sending of butter and cheese by parcel post.

129 - The Frozen Meat Trade in Venezuela. -- *Le Froid*, Year VI, Vol. VI, No. 7, p. 125. Paris, July, 1918.

The Venezuelan Meat and Products Syndicate, Ltd., is the only company exporting frozen meat from Venezuela. Of English origin, it was founded over 8 years ago with a capital of 3 917 700 *bolivars* (1), and has not ceased to progress since then. The factory is at Puerto-Cabello, $\frac{1}{2}$ mile from the landing-stage, to which the products are carried by the English railway company of Puerto-Cabello to Valencia. The plant allows for the slaughtering of 300 oxen daily and the freezing rooms can hold more than 3 000 metric tons of frozen meat. The company sells its products to the English and French governments, orders being taken directly by the head office at London. Recently the company has bought 1 235 sq. miles of breeding land in Venezuela. The salt and frozen meat exported from Puerto-Cabello was 142 222 lb. in 1913, with a value of 68 331 *bolivars*, 7 894 236 lb. worth 1 402 352 *bolivars* in 1915, and 7 308 955 lb., valued at 1 671 080 *bolivars* in 1916.

(1) 1 gold *bolivar* = $5\frac{1}{2}$ d. at par (F.d.)

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- 130 - Non-parasitical Disease of the Vine Observed in New York State, U. S. A. —**
GLADWIN, T. B., in the *New York Agricultural Experiment Station, Bulletin No. 449*, pp. 99
110 + 3 Plates. Geneva, N. Y., 1918.

A non-parasitical disease of the vine, observed since 1910 in the vineyards of the Agricultural Experiment Station of Geneva, N. Y., is described. On the surface of the leaves appear yellow streaks on either side of the veins and near the edge, where they often join to form a continuous line. The parts affected dry up as the season advances, and, when the disease is widespread, the loss of a large proportion of the leaves may seriously harm the plant. Growth stops, the wood does not ripen, the sugar content of the grapes is decreased and their bad colour spoils the appearance of the bunches. The value of the fruit is much depreciated.

The chief causes of the disease are insufficient organic matter in the soil and low hygroscopicity, drought in light and permeable soils, excess of water which, in badly drained or impermeable soils, prevents respiration of the roots. Treatment with ferrous sulphate, so valuable for chlorosis, has no effect in this case. The treatments recommended are: -
1) cultural methods to preserve the moisture of the soil; 2) organic fertilisers to increase the hygroscopicity of the soil; 3) good drainage.

- 131 - Coffee Trees Injured by Frost in Brazil, See No. 58 of this Review.**

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

- 132 - Fungi from British Borneo. - YALIS, H. S., in the *Philippine Journal of Science*
Section C, Botany, Vol. XIII, No. 4, pp. 233-240. Manila, July, 1918.**

A list is given of 21 forms collected by the author in October, 1917, in British North Borneo, chiefly along the coast. Five species are described as new to science, and others as new to Borneo. Special mention may be made of: —

- 1) *Meliola Pterocarpi* n. sp. on leaves of *Pterocarpus indicus*;
- 2) *M. Otophorae* n. sp., on leaves of *Otophora fruticosa*;
- 3) *M. jasminicola* P. Henn., on *Jasminum Sambac*;
- 4) *M. Mangiferae* Earle on leaves of *Mangifera indica* (1);

(1) See R. Oct., 1918 No. 1173. (Ed.)

Montriond road, however, he found twelve out of about sixty ears he examined to be attacked by rye ergot (*Claviceps purpurea* [Fr.] Tul.). This fungus is very rarely found on wheat, although it has long been known to attack gramineae other than rye.

The ergot observed was very characteristic but differed from that found on rye in its length, 10 to 18 mm., breadth, 3 to 6 mm., and early and stable furrow, sometimes causing one or more lobes, and its more compact texture. The morphology of this ergot probably depends on its habitat, and its composition differs fairly widely from that of rye ergot. According to the author it should be put in a class quite distinct from that of rye ergot under the same of *Cl. purpurea* f. *Tritici* or f. *Tritici-Manitobae*, until its germination and resultant reproduction organs have been studied. Infection experiments should be made with the ascospores on rye to see whether the transition from rye ergot to wheat ergot is as easy as supposed.

There is no cause for alarm, Manitoba wheat being so slightly attacked by this parasite. Nevertheless the author thinks ergot may be more easily acclimatised on this Canadian wheat than on the old varieties, and that it would be wise to begin immediately the control of seed supplied to farmers. The author found no sign of ergot on the gramineae next to the infected field not even on rye.

II. - M. FOURRIER, Director of the Agricultural Service of Upper Saône also reports the rareness of ergot on wheat. Nevertheless, in 1918, he found it in Upper Saône in abundance on Alsatian buckwheat, a variety largely grown in this department and most of north-eastern France. This seems to show that the parasite attacks the native varieties as well as Manitoba wheat.

136 - ***Verticillium albo-atrum*, a Hyphomycetes Injurious to Cucumber, in Holland** (1). - VAN DER LEE H. A. A., in *Mededeelingen van de Landbouwkundige school en in de Daaraan Verbonden Instituten* Vol. XV, Pt. 1, pp. 1-15 + 6 Plates. Wageningen, 1918

In 1916 diseased cucumber plants were received at the Wageningen Plant Pathology Institute. Mycelium of *Verticillium albo-atrum* were found on them and isolated. Infection experiments were then made on cucumber and potato plants. The first were either grown in sterile soil at first and infected after by mixing in the soil pieces of the diseased cucumber plants received for examination or pure cultures isolated from cucumber and potato plants, or else inoculated at the bases of the stem with pure cultures of the same origin introduced by making deep cuts affecting the ducts. The potatoes were either inoculated at the base of the stem or grown in soil infected by pure cultures isolated from cucumber and potato plants. After a more or less long period of time all the experiments gave positive results and, in many cases, it was possible to re-isolate the fungus from the cucumber plants used for the experiment.

The experiments were repeated on a larger scale in 1917. Inoculation experiments were made with the fungus isolated from potato. Infection

(1) See *R May* 1918 No 590. (*Fd.*)

experiments with fungus spores on cucumbers gave positive results. Plants known to be infected should be removed from the field and immediately destroyed to prevent the spores from spreading. The best method of control would, however, be to create resistant varieties.

137 - Apple Bitter Rot and its Control. — ROBERTS, J. W. and PIERCE, I., in the *U. S. Department of Agriculture, Farmers' Bulletin* 938, pp. 1-14 + 1 Figs. Washington, April, 1918.

Apple bitter rot, caused by *Glomerella cingulata*, is especially severe in Arkansas, southern Missouri and southern Illinois, where the hot summer and moisture favour the development and spread of the disease. The first signs of the disease are the appearance of light brown, sometimes almost colourless spots just beneath the skin of the fruit. In a few days the infected areas may attain a diameter of 1 inch. The tissues beneath the spots are rotted and soft. This makes it possible to distinguish bitter rot from black rot, caused by *Sphaeroopsis Malorum*. The rotted area may increase in size until the whole apple is involved or it may stop at the first stages, leaving nothing but a cone-shaped cavity covered by hard skin.

The parasite is particularly injurious in its conidial form. The germ tube penetrates into the flesh of the apple and produces mycelium in and between the cells, thus causing disintegration of the tissues. The fungus also produces ascospores which, however, are not of great importance in spreading the disease. The masses of conidia on the surface of the fruit are transmitted to other fruit by insects or rain. At first these masses are mucilaginous and thus the conidia are more easily carried by insects. The fungus, besides affecting the fruit, also causes cankers on the branches of the trees. At the diseased spot the bark dries up and cracks in a characteristic manner.

The two principal agents in the transmission of the disease from year to year are mummified apples full of the fructifications of the fungus, and cankers on the branches which contain an enormous number of spores. The control measures recommended are: — 1) Spraying with Bordeaux mixture so that the fruit is well covered, to prevent the germ tube of the conidia from penetrating the flesh; 2) careful collection and destruction of all mummified fruit; 3) removal of the cankerous branches and sterilisation of the cuts with mercuric chloride.

All varieties of apples are not equally subject to bitter rot; they may be divided into four classes:—

1) very susceptible: — Corfu, Fallawater, Gibbs, Givens, Highfill, Huntsman, Lansingburg, Smokehouse, Willow, Yellow Newtown;

2) moderately susceptible: — Ben Davis, Gano, Grimes, Jonathan, Limbertwig, Missouri, Nero, Northern Spy, Northwestern, Oliver, Paradise, Pilot, Smith, Stark, Winter Queen, York Stripe;

3) fairly resistant: — Arkansas, Baldwin, Delicious, Maiden Blush, Rome Beauty, Stayman Winesap, York Imperial;

4) slightly susceptible or resistant: — Akin, Arkansas Black, Bismark, Langford, Ralls, Salome, Winesap.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

138 - **New Zealand Syrphidae.** -- MILLER, D, in *The New Zealand Journal of Agriculture*, Vol. XVII, No. 3, pp. 129-135 + 7 Figs., Wellington, 1918.

The diptera of the *Syrphidae* family are well represented in New Zealand, not so much by numerous distinct species as by an abundance of individuals of one species. Although most of the *Syrphidae* when in the larval stage are useful to agriculture as destroyers of various injurious insects, some of them are harmful to plants, man, and domestic animals.

So far as is known the two most common and important useful species in New Zealand are *Syrphus novae-zealandiae* (New Zealand syrphus fly) and *Melanostoma fasciatum* (banded melanostoma). Their larvae devour large numbers of aphides and injurious larvae, amongst which are *Phthorimaea operculella* (potato-tuber moth) (1), *Plutella cruciferarum* (diamond back moth) (2), and another indetermined lepidopteron which attacks the leaves of *Cordyline indivisa* (cabbage tree). Another species (*S. viridiceps* -- *S. obsesus*), very common in Australia, the larvae of which are known to destroy aphides, is also found sometimes in New Zealand, especially in Auckland, but is not yet definitely settled there. The larvae of two other less abundant *Syrphidae* -- *S. ropalus* and *S. ortas* -- have been observed attacking larvae of the lepidopteron *Venusia verriculata* -- injurious to leaves of *Cord. indivisa* -- and those of *Xanthorrhoea praefectata* (3) and *Melanchra steropastis*, all well known to be injurious to leaves of *Phormium tenax* (New Zealand flax).

About ten species of injurious *Syrphidae* are known in New Zealand. The most common of these is perhaps *Eristalis tenax* (European drone-fly). Another injurious species, like the preceding one, of European origin, is *Merodon equestris* (narcissus fly) (4).

139 - **Patents for the Control of Pests of Plants.** See No. 104 of this *Review*

140 ***Phthorimaea operculella*, a Microlepidopteron Injurious to Potato in Morocco** (5). -- *Bulletin de la Société entomologique de France*, No. 16, p. 222 Paris, 1918

M. J. DE JOANNIS received from M. R. BENOIST specimens of *Phthorimaea operculella* Zell. taken from larvae which were doing considerable damage to potatoes at Casablanca, western Morocco.

141 - **The Control of the Clover-Flower Midge, in America.** -- CRIFF, C W and ROCKWOOD, L. P., in the *U. S. Department of Agriculture, Farmers' Bulletin* 971, pp. 1-12 + 7 Figs. W shington, June, 1918

The clover-flower midge (*Dasyneura leguminicola* [Lintner]), lays its eggs in young clover heads. When the larvae emerge they eat the essential parts of the flower, thus considerably reducing the seed crop. Although

(1) See *R. Oct*, 1918, No. 1183, and No. 140 of this *Review* -- (2) See *R. Dec*, 1910, p. 380; May 1916, No. 568; Feb. 1917, No. 205; Nov., 1917, No. 1084. -- (3) See *R. Dec*, 1916, No. 1344. -- (4) See *R. Dec*, 1912, No. 1699; Oct., 1914, No. 974. (*Ed*)

(5) See *R. Oct*, 1918, No. 1183, and No. 138 of this *Review*. (*Ed*)

no exact data on the geographical distribution of the insect are available, there is no doubt that it is widespread in America. It has been observed in New England for many years. There are three generations a year, but it is the larvae of the second generation which do most damage. The control measures recommended are: -- 1) early cutting of the clover; 2) pasturing cattle in infected meadows from the beginning of spring till late in May or early in June.

142 - Control of *Lasioderma serricorne* and *Setomorpha margalaestriata*, Injurious to Tobacco in Java (1). -- JENSEN, H., in *Proefstation voor Vorstenlandsche Tabak, Mededeelin*, No. 30, pp. 1-29, Samarang, 1917

The position of the tobacco plantations in Vorstenlanden does not favour the propagation of *Lasioderma serricorne* and *Setomorpha margalaestriata* ("tabaksmot"); the crop, in normal times, being kept only six months at the most in the sheds which are very clean. Since recently, owing to lack of tonnage, the period between the harvest and shipping has been longer than it was previously, there is, as a result, danger of infection. The Tobacco Experiment Station of Vorstenlanden has, therefore, undertaken investigations into the best method of control. The results obtained showed that 100 to 150 cc. of carbon bisulphide per cubic metre is sufficient in the disinfecting sheds. Benzene may be used as a disinfectant so long as the air is perfectly saturated with it and the action lasts five or six days. Neither sulphur dioxide nor formalin fumes have any effect on *Lasioderma*. The tobacco sheds should be protected with mosquito nets. It was shown that infection comes from without, passing through the welt of the bales. Carbon bisulphide treatment does not decrease the burning qualities of the tobacco. When inspecting tobacco sheds not only the tobacco waste should be examined, but also waste of other products, fodder, rice, etc., which may be stored there.

143 *Mertila malayensis*, a Hemipteron Injurious to Orchids, in Java. -- ROEPKE, W., in *Lycimnia*, Year XXIX, Pt. 4, pp. 200-212, 9 Figs. Batavia, 1918.

The presence is reported in Java of *Mertila malayensis* Dist., injurious to orchids, especially *Phalaenopsis amabilis*. The female lays its eggs on the leaves of the plant host, piercing the blade. All round the hole the chlorophyll disappears, leaving white patches which, when the attack is serious, merge together, covering the whole blade which dries up. Whole plants are thus destroyed. As a control measure arsenic might prove efficacious, but injures the plant. All that remains, therefore, is direct destruction of the larvae and adults by native labour. This method has given satisfactory results.

144 *Rhizoglyphus sagittatae* n. sp., an Acarian Injurious to the Balsam-root Plant, in Montana, U. S. A. -- FARST, E. C., in *Entomological News*, Vol. XXIX, No. 9, pp. 331-340 + 1 Plate, Philadelphia, November, 1918.

A description is given of *Rhizoglyphus sagittatae* n. sp. (fam. Tyroglyphidae), a species closely related to *R. hyacenthi* (Boisduval) and *R. rhiz-*

phagus Banks. This mite was found, in June, 1916, at Missoula, western Montana, gnawing and sucking the new leaves of the balsam-root plant (*Balsamorhiza sagittata* Nutt.). Neither the radical system nor the underground stem was infected, and no other plants in the neighbourhood were attacked.

145 - **A New Mite Attacking Valley Cottonwood, in Texas, U.S.A.** — O'GARA, P. J., in, the *Journal of Economic Entomology*, Vol. XI, No. 5, p. 130 + 1 Plate Concord, N. H. October, 1918.

In May, 1918, the author observed, near El Paso, Texas, a marked infestation on the current year branches of *Populus Wislizeni*. Whereas the top leaves were normal, the blades of those beneath them were much reduced and cut near the end of the petiole, and the general appearance that of a fairly round inflorescence. An examination of attacked leaves showed the presence of a very small mite, belonging to a new species of *Eriophyes* hitherto undescribed. The type of injury done by the mite is also new.

[144-145]

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

146 — **Produce of French West Africa.** — FRANÇOIS, G., *Ministère des Colonies Office colonial*, 156 pp. Melun, 1918.

The studies of M. G. FRANÇOIS on the produce of French West Africa published from time to time in the *Bulletin de l'Office colonial*, have recently been collected into one volume by the Colonial Office of the French Colonial Ministry. In the first part of his work the author discusses French West Africa in general. This territory of 1 218 131 sq. miles includes Senegal, Upper Senegal-Niger, Guinea, Ivory Coast, Dahomey, Mauritania and Niger and has a population of about 12 million. According to M. A. CHEVALIER the great natural regions of this immense possession are, from north to south —

1) *Sahelian region*, with a short rainy season during which 20 to 35 cm. of rain falls per annum. It is composed of large bare stretches and thorny bushes, often growing in tufts. In the north it touches the Sahara, and its uncertain border, which goes from 17 to 21 degrees of north latitude, has been traced according to M. CHUDEAT's studies. It is traversed by two flood districts, one formed by the Niger in the Timbuctoo district, the other by the Senegal in the Podor district.

2) *Sudan region*, including the districts flooded after the rainy season by the water of the Niger, Bani, Volta, and other rivers, plains covered with sparse brush, or table-land covered with brush, more numerous trees and more varied botanical species. The flood district of the Niger and Bani alone covers more than 988 000 acres, more or less regularly irrigated. The possibility of increasing the acreage thus naturally watered by means of

suitable works, is now being considered. This part of Upper Senegal-Niger is certainly the richest of West Africa, and that with the most brilliant future as soon as the Thies-Kayes railway is finished.

3) *Guinea region*, including table-lands and valleys at an altitude of from 980 to 2 620 ft., through which run permanent rivers, bordered by forest tracks and chains of mountains from Kouakry to Central Sassandra, a distance of about 620 miles. The height of these mountains varies from 2 620 to 4 920 ft., and in them rises a whole network of rivers, the Senegal, Gambia, Niger, Kavalley, Saint-Paul, and Sassandra.

4) *The low plains* lie between the forest tracks just mentioned and the large Baoulé forest in Lower and Central Dahomey and Lagos. Forest tracks are rare here, but there are rich plantations of oil palms, savannas covered with borassus, and yam crops.

5) *The large virgin forest* covers the south of French Guinea, Liberia, a part of the Ivory Coast and the British Gold Coast; it is connected by forest stretches in Dahomey to the great forest of the equator.

In all these different districts are found products which might be exploited or used locally. These products may be divided into two groups :

- A) forest produce, including rubber, palms (oil palms, borassus, palmyra), coconut palms, timber, kapok, shea butter, gum, cola ; B) agricultural products and food plants, i. e. those grown in fields by the natives or receiving a certain amount of care (peanuts, sesame, cotton, sorghum, rice, manioc, yam, sweet potato, banana, coffee, cacao, tropical fruit, etc.) For convenience this produce is divided into seven groups : - 1) fats ; 2) textiles and fibres, 3) cereals, leguminosae, and tuber plants ; 4) forest and brush produce ; 5) other crops and tropical fruits, 6) native cattle, 7) fish.

I. **FATS.** This part has already been summarised in this *Review* (1).

II. **TEXTILES AND FIBRES** The commercial utilisation of the French West African textile plants is only just beginning, though some of them are used in large quantities by the natives. Deccan hemp, kapok, sisal and others like cotton should be widely cultivated in the future. The two vegetable textiles most largely grown are cotton and Deccan hemp. Other valuable native textiles are Guinea bowstring hemp, pineapple, the fibre of the leaves of certain palms (rassia, coconut, oil palm). To these should be added kapok and an agave introduced into Upper Senegal-Niger a few years ago.

Cotton. - The Colonial Cotton Association, formed about fifteen years before the war to improve cotton-growing, interested itself in French West Africa. In Senegal, Upper Senegal Niger, the Ivory Coast and Dahomey, the natives already knew cotton and cultivated it without irrigation, as in the United States. A few native irrigated crops do, however, exist. In Senegal a native species of cotton grows wild. The cotton is very white, but the staple is rather short. Experiments made by the Colonial Cotton Association with the Egyptian varieties Mit Afifi and Abassi gave excel-

(1) See *R.* Oct., 1917, No. 920. (Ed.)

lent results. The future of cotton in Senegal seems to rest especially with the irrigated crops. The variety most commonly grown by the natives in Upper Senegal-Niger is related to the species known as *Gossypium punctatum* the pods are small, the fibre short, but strong and very white; the ginning yield is 25 %. A description is given of the work of the Colonial Cotton Association and the production in the various colonies already mentioned.

Kapok. — The vegetable staple known commercially as "kapok" (Malay name of the tree or product) is a floss obtained from pods of large trees of the Bombaceae family. Bombaceae producing real kapok or a substitute may be divided into four groups, two of which, *Ceiba* (or *Eriodendron*) and *Bombax*, include African species. A kapok tree of the *Ceiba* genus, *Eriodendron anfractuosum*, is cultivated in the Malay Peninsula, in Cambodia, and in French West Africa. This species supplies ⁹/₁₀ of the world's consumption of kapok. *Bombax buonopozense* is the species most common in French West Africa, where it is known as "faux cotonnier" or "fromager", as well as throughout the African continent. It grows in small clumps or thick, very large plantations, from the Atlantic coast to the Tchad territories, in the savannas, and forests (1). It is common in Senegal and Casamance, abundant in the arid district of M' Bafar and in Baol, and is found everywhere from N' Diourbel to the Niger, and in Ferbo. In Guinea it is found on the western table-lands towards 9.55° of north latitude in the Friguigbé district. It is widespread in Fouta-Djallon. Towards the north it grows nearly as far as Niore, Goumbou, and Sokolo. In the west, round the curve of the Niger, it reaches a little above 15°; more to the east, the northern limit turns suddenly southward, and the tree grows even in the most arid soils. On the Ivory Coast it is found in both forests and savannas. It is not uncommon in Dahomey. The exploitation of *Bombax* for kapok is at present restricted to Upper Senegal-Niger and the Ivory Coast. These are the only two French colonies, with the exception of Cambodia, which export kapok. The exportation from the first colony rose from 1 100 lb. in 1911 to 72 700 lb. in 1916, and, from the second, it rose from 6 000 lb. in 1913 to 91 800 lb. in 1916. African kapok is much appreciated and comparable to the best Javanese varieties.

Deccan hemp. — Deccan hemp, known as dā, the Bambara name for *Hibiscus cannabinus*, is a Malvaceae cultivated by the natives for their personal needs in the valleys of the Niger and Bani, between 13° and 15° north latitude, in the circles of Bamako, Ségon, Mopti, Djenné, and Kou-tiala. According to M. VUILLET the natives distinguish three species: — 1) Deccan hemp which grows wild in the Niger flood district, in the basin of the Debo; 2) that grown in isolated crops along the Niger and the Bani, in the plains periodically flooded, or at least moistened by the high waters (Somonos district); 3) that of dry soil, which differs from the preceding ones by a higher and stronger stem; it is cultivated between maize or

(1) VUILLET, Le kapok africain, in *Les grands produits végétaux des Colonies françaises*. (Author).

millet in well-drained vegetable mould (Bambaras district). In 1907, the Administration had experiments made on the utilisation of African Deccan hemp. The results showed that, for the moment, this plant cannot advantageously replace jute for making fabric, but in rope-making equals jute in value.

III. — CEREALS, LEGUMINOSAE, ROOT AND TUBER PLANTS. — French West Africa is no less well supplied with food than other crops, but these, for the most part, are at present all consumed locally. The author studies these crops one by one; they are:—

1) Cereals: sorghum, millet. "fonio" or "fini" (*Paspalum exile*), wheat, rice, maize;

2) Leguminosae. "voandzou" or "underground bean" (*L'ound-zeia subterranea*), "dougoufola" (*Kerstingiella geocarpa*), cow pea (especially "niebé" or "sosso", *Vigna Catjang*), pigeon pea (*Cajanus indicus*), "white bean" (*Phaseolus lunatus*);

3) Roots and tubers; manioc, yam, taio, edible galingale.

IV. FOREST AND BRUSH PRODUCE. — *Rubber*. A few years ago rubber was one of the principal exports of West Africa, if not in quality, at least in value. On a whole the production of rubber is decreasing in West Africa, though large quantities are still exported and its quality has improved. The rubber is obtained from wild liana of the genera *Landolphia* (*L. Heudelotii* and *L. owariensis*) and *Clitandra* (*C. elastica*), and a tree, the "irch" (*Funtumia elastica*). The question of rubber in French West Africa is treated in full.

Timber. — The forest of the Ivory Coast is one of the largest in the world. Till recent years the only wood exported from the Ivory Coast was mahogany (*Kaya ivorensis*). As this wood was exploited by the cutters only it is possible that *Entandrophragma septentrionale* or *E. macrophyllum* were included to a certain extent in deliveries of mahogany. The most valuable species besides mahogany are: "azobé", "édoum" (*Chlorophora excelsa*), "nété" (*Piptadenia africana*) "sougué" (*Albizia rhombilolia*) "fakpo" (*Albizia gigantea*), "avodiré" (*Antiaris toxicaria*), "hétééré" or "okumé" of the Ivory Coast (*Canarium occiaentiale*), "badi" (*Sarcocephalus Pobeguini*). Commercially these woods may be qualified as follows:— azobé and édoum, African teak; nété and sougué, African oak; fakpo, African walnut; avodiré and hétééré, pitch-pine substitutes; badi, African lemon tree. The following species are mentioned as of probable value: "mérault" (*Musanga Smithii*), "serama" (*Triplochiton scleroxylon*), mangrove (*Rhizophora*), "iroco" (*Chlorophora excelsa*), "uvaria" (*Pachypodanthium Staudtii* = *Uvaria Staudtii*), "kakania" (*Pachystela cinerea*), "okume" or hétééré (*Canarium occidentale*), "fraké" or "fram" (*Terminalia altissima*), "tiamia-tiamia" (*Entandrophragma septentrionale*, *E. macrophyllum*, *E. rujum*, A. Chevalier), African cedar (*Trichilia cedrata*), "makoré" (*Dunoria Heckelii*).

Gum. — Senegal and Soudan gum is supplied principally by *Acacia Verek*.

Copal resin. — This is produced by a large tree which is probably

Copaifera copallina. In 1909, *Hymenaea Courbaril* and *H. verrucosa* were introduced into Guinea.

The author also studies the cola tree (*Cola acuminata* and *C. nitida*), the palmyra and doum palms (the nuts of which give vegetable ivory), and the "gonakié" (utilised for its wood, and the fruit of which contains tanning matter).

V. — OTHER CROPS AND TROPICAL FRUIT. — These include cacao and coffee, the first of which in particular is being more largely grown on the Ivory Coast, and the cultivation of tropical fruits, which does well and is increasing in French Guinea. These crops are all studied separately.

VI. — BREEDING. — This is one of the most certain and most important sources of wealth of French West Africa. The last census (1912) showed there to be 116 000 horses, 7 800 000 cattle, 5 500 000 goats, and 4 500 000 sheep.

VII. — The fisheries of Mauritania and Senegal are studied

14. — **Associations for the Destruction of Mosquitos and Making Malarial Land Healthy, in Italy.** — Ministero per l'Agricoltura, Istituto generale di Bonifica agraria della Colonizzazione ed il Credito Agrario; I Comandi militari ricevono il suo nome e delle terre malariche. Rassegna di Istoria e Geografia. Prof. RATTOLLO, 177 pp. Coop. Tipografica Ital., Rome, 1918.

This publication contains a report on the subject studied, a draft for a decree, drawn up by the author and nine appendices containing criticisms of this draft by Italian scientific authorities. The judicial side of the problem of making malarial land healthy is developed in the report in all its aspects, together with the general problem of large and small land improvements and colonisation. The draft for a decree on associations for the control of mosquitos and making malarial land healthy is based on the principle that the elimination of malaria must be undertaken by the authorities of the malarial lands with the help of State subsidies; it should not be directed by a State committee for the eradication of malaria, thus affecting the measures of the State committee for the improvement of the land. The draft may be summarised as follows:—

Art. 1. — Owners of estates in malarial districts shall contribute to the destruction of mosquitos and it shall be obligatory for them to form Associations for this purpose subject to technical regulations to be issued by the Ministry of Agriculture on the recommendation of a permanent supervision Committee, nominated by royal decree and proposed by the Ministries of Agriculture, the Interior, and Public Works.

Art. 2. — The Ministry of Agriculture may allocate to the Associations grants for starting the work or annual grants, on the recommendation of the Committee mentioned in Art. 1 and, at their request, to districts most seriously affected with malaria. On the proposal of this Committee the Ministry of Agriculture may award premiums to those Associations the districts of which, during the first 10 years after the law comes into force, are declared by the Ministry of the Interior to be free from malaria; awards may also be made to the most deserving organisers for active and efficient propaganda and good working of the Associations. The

Ministry of the Interior shall supply the Associations with denaturalised salt and denaturalised petroleum at reduced prices.

Art. 4. — The Communities in whose territories are districts declared malarial shall adapt their rural police and soil hygiene regulations to the prescriptions and instructions given by the Ministry of Agriculture when the decree is applied and must carry out the small land improvements imposed upon the Associations which are lacking, independantly of the civil responsibility of the landowners and their responsibility for evasions of the decree, punishable according to the local rural police and soil hygiene regulations.

Power is also given to malarial provinces to organise the small land improvements and rural police by special provincial regulations and to order mechanical protection against mosquitos in districts where their destruction is particularly difficult.

Art. 5. The teaching of the regulations and instructions on small land improvements and methods of destroying mosquitoes shall be obligatory in all schools of agriculture and normal and elementary rural schools of the Communes in the territories of which are malarial districts.

Art. 6. To the general Inspection Board of Land Improvement and Colonisation of the Ministry of Agriculture, is attached a Technical Consulting and Advisory Office of Soil Science for helping Associations for the Destruction of Mosquitos, which, according to rules and conditions to be laid down by a special regulation, shall help the Associations, even in the drafting of schemes for small land improvements and drainage, etc.

148 - The Nitrogen Requirement of the Organism. — *Comptes rendus des Séances de la Société de Biologie (Mémoires)*, Vol. LXXXI, No. 22, pp. 1163-1164. Paris, December, 1918.

The meetings of the Food Commission of the French Society of Biology, held in Paris, led to the following conclusions with regard to the nitrogen requirement of the organism.

1) Albuminoids are essential in food not so much for themselves as for the amino-acids they contain. The requirement of the organism can only be specified by a very complicated qualitative account.

2) Physiology cannot yet draw up such a table of which only a few figures are known; the amino acid requirement is essential but very small quantitatively. The vitamins form a particular case of this general rule.

3) In a diet sufficient from a point of view of energy-yield and specially chosen with respect to the quality of the albuminoids, the daily allowance of albuminoids may be very small.

4) In practical feeding problems such results cannot be taken as a basis. The total albuminoid ration must be sufficiently great to satisfy all requirements.

5) Taking into consideration ethnographical observations, which have the advantage of being natural experiments on an enormous number of people and several generations, the minimum requirement for the maintenance of an adult may be fixed, according to the formula given by

LAPICQUE in 1894, at 1 gramme of albuminoids daily per kilogramme (2.2 lb.) of body weight, the energy requirement being satisfied elsewhere.

6) This rule implies a mixed diet; in a strictly vegetarian diet the quality of the albuminoids must be analysed, e. g., a diet of rice alone appears insufficient.

7) The case of the worker does not demand particular attention as work does not consume albuminoids and every increase in ration entails an increase in the quantity of albuminoids.

8) Children, young people, pregnant women and wet-nurses, i. e. all organisms growing directly or indirectly, require special attention with regard to nitrogen when food is scarce. It is wise to give them a small quantity of animal albumin in addition to the diet already prescribed.

149 - Experiments in the Determination of the Digestibility of Millets. — LANGWORTHY, C. F. and HOLMES, A. D., in the U. S. Department of Agriculture, *Bulletin* No. 525, 9 pp. Washington, April 7, 1917.

A description is given of a study on the digestibility of common millet (*Setaria italica*) and proso (*Panicum miliaceum*) by the methods used in the previous studies on the digestibility of sorghum (1). The two varieties of millet were eaten in the form of bread in a basal ration poor in protein made up of potatoes, oranges and sugar. The subjects were five normal men. As millet does not contain gluten it is not suitable for making leavened bread if used alone, but makes an unleavened bread suitable to the same cooking purposes as sorghum and maize flour. The average amount of protein in the ration was less than 50 grammes a day owing to the low protein content of the millets used. The digestibility of the protein of the bread made with the bolted flour of common millet (loss at bolting 40 %) and of proso (loss at bolting 29 %) was low — 35.8 % for common millet and 41.2 % for proso. There was little difference in the flavour of the two kinds of bread. Decorticated millet boiled to a mush was found to have a pleasant flavour, but its digestibility was not tested. The carbohydrates of both millet and proso were utilised by the subjects as well as that of ordinary cereals, i. e. 95.7 % for millet and 96.2 % for proso.

CONCLUSIONS - Millet and proso in a diet contribute to a certain extent to the protein, but are of much greater importance as sources of carbohydrates. They, therefore, resemble grains such as those of sorghum more than those of wheat and rye which supply large quantities of both protein and carbohydrates.

CROPS AND CULTIVATION.

150 - New Method of Predicting Frost. - I. WARREN SMITH, J., Predicting Minimum Temperatures, in the *Monthly Weather Review*, Vol. XLV, No. 8, pp. 302-307. Washington, August, 1917. — II. NICHOLS, E. S., Predicting Minimum Temperatures in Grand Valley, Colorado, *Ibid.*, Vol. XLVI, No. 5, pp. 213-228 + 9 Figs. Washington, May, 1918.

In the United States, where fumigations and irrigations are being used

(1) See R. July, 1917, No. 633 (Ed.)

more and more against frost, the predicting of low temperatures is of great importance. The first paper gives the outlines of a new method of forecasting drawn up by Mr. WARREN SMITH and based on observations made chiefly in Ohio. In the second paper Mr. NICHOLS describes the results he obtained by applying SMITH's formula in the Grand Valley, Colorado.

I. — It is admitted that the minimum temperature of clear, windless nights differs little, in a negative sense, from the temperature at dewpoint the preceding evening. The application of this principle has, however, given anything but satisfactory results. In certain cases the minimum night temperature was 20° F. lower than the corresponding temperature at dewpoint, in other cases it was 10° F. higher.

From March to June 1915, a series of observations was made daily between 5 to 7 a. m. and 5 to 7 p. m. in twelve localities of Ohio of the maximum and minimum temperatures, the temperatures of dry and wet bulb thermometers, direction and velocity of the wind, rainfall, and general atmospheric conditions. An important conclusion was drawn from the numerous data thus collected. It was found that when the atmospheric humidity at the hour of observation in the evening was below 40 %, the minimum temperature of the following night was *above* that at dewpoint; when, however, this humidity exceeded 50 %, the minimum night temperature was *below* that at dewpoint. The averages obtained were:

Relative humidity	Minimum night temperature
1) Below 40 %	5° F. <i>above</i> the evening dewpoint
2) From 40-50 %	Close to " " "
3) From 50-65 %	2° <i>below</i> " " "
4) From 65-80 %	6-8° <i>below</i> " " "
5) Over 80 %	> 12° <i>below</i> " " "

Between R , the relative evening humidity, and Y , the deviation of the night minimum from the dewpoint, there is a marked negative correlation. Thus, at Germantown, Ohio, r , the correlation coefficient, is as high as -0.865 ± 0.014 . From 360 observations in different localities in the States of Ohio, Washington, Oregon, and Wisconsin, the average value obtained for r was -0.552 ± 0.0025 , i. e. 28 times greater than the probable error.

The new method for predicting frosts drawn up by Mr. WARREN SMITH is based on this correlation to calculate the deviation between the minimum night temperature and the dewpoint. This deviation $Y = a + bR$. To solve this equation the values of a and b must be known. They are calculated by the formula:

$$a = \frac{\sum Y - b (\sum R)}{n} \text{ and } b = \frac{n (\sum R Y) - (\sum R) (\sum Y)}{n (\sum R^2) - (\sum R)^2}$$

the terms of which must be given in a special table for each locality, as a and b vary from one station to another. Below is a summary (5 cases out of 25) of the table drawn up for Germantown.

Date			R^2	RY
12	March	47 %	0	0
13	"	35	+ 4	+ 140
27	"	53	- 1	- 53
<hr/>				
26	June	47 %	- 1	- 47
27	"	37	+ 3	+ 111
<hr/>				
$n =$		ΣR 1315	$\Sigma Y = -55$	$\Sigma R^2 = 72.47$
				$\Sigma RY = -4182$

It, with the aid of data given in this table, the formulae given above are applied, the values obtained are $a = 18.314$ and $b = -0.39$. It is thus possible to solve the equation $Y = a + bR$ or $Y = 18.314 - 0.39R$.

The following is an example of a forecast of the minimum night temperature made by applying this formula. At Germantown on the evening of May 1st the relative atmospheric humidity was 52.2 %. By putting this value in the place of R , the formula becomes $Y = 18.314 - (0.39 \times 52) = 2.4$, i. e., towards the morning of May 2nd, the minimum temperature should have been 2° F. below the dewpoint, or equal to 39.6° F., in reality it was 38° F., the error in predicting being below 1.6° F. In other cases the error is greater but always much below that obtained by taking the temperature at dewpoint as a basis.

II - The observations reported were made in the Grand River Valley at the Grand Junction Station and the Sub-stations of Fruitvale, Palisade, Orchard Mesa, Pomona, Hunter, Fruita, and Loma. The nights are classified in five groups:

- 1) Sky clear, wind velocity below 10 miles an hour; high pressure area above, or immediately west or north-west.
- 2) Sky and wind as in 1), high pressure area immediately east or north-east.
- 3) Sky clear, wind velocity 10 miles or more per hour.
- 4) Sky partly cloudy, wind velocity less than 10 miles per hour.
- 5) Sky partly cloudy; wind velocity 10 miles or more per hour.

During March and April the values of r , a and b were calculated for each of these classes. The coefficient r between the relative humidity R and the deviation Y was very high, even for nights with partly covered sky and wind velocity exceeding 10 miles an hour, so that WARREN SMITH'S formula may be applied even in this case. When there is a marked correlation between the hygrometric values (relative humidity of evening air) of different localities in the same district SMITH'S formula may be used to determine the minimum night temperature, not only for the locality in which the observations are made, but also for those at a distance which are in correlation with it.

- 151 **The First Autumn Frosts in Mexico.** — LOPEZ, E., in *La Revista Agrícola*, Vol I No 4, pp 131-133 + 1 Map. Mexico City, 1917

The last spring and first autumn frosts often do considerable damage in the high table-lands ("mesetas") of Mexico. The author gives the results of a study on the first autumn frosts. There are 15 districts which are most seriously threatened by these frosts, forming a vast ellipsoidal area stretching from Jalapa in the east to Guadalajara in the west, and from S. María del Río in the north to Puebla in the south. It includes a large part of the provinces of Mexico, Hidalgo, Guanajuato, Michoacan and Jalisco. Further to the north, between the 25th and 27th parallel, is another large threatened area including nearly all the province of Durango and the south of Chihuahua.

Between these principal zones are three smaller ones, one of which occupies the centre of Zacatecas and a large part of Aguas Calientes. Along the Tampico-Paso del Norte line are six distinct consecutive zones. There is also a "threatened zone" near the town of Carmen on the Gulf of Mexico, and another in the mountainous district of S. Cristobal, a little above 16° of northern latitude.

High pressure in the north or north-west, coming from the United States, a well-defined cyclone zone in the south, and a north wind over the gulf are the phenomena which precede frost and make it possible to predict it days in advance. In 1917 the first autumn frosts were reported on September 25th 26th.

- 152 **The Influence of Weather on the Development of Agriculture in Michigan, U. S. A.** — DEWRY, A. S., in the *Thirtieth Report of the Experiment Station Michigan*, pp 683-715 + 18 Maps. Lansing, Michigan, 1917

The climate of Michigan is greatly influenced by the neighbouring large lakes, especially with respect to precipitation and temperature. These large sheets of water give off, particularly in summer, a considerable quantity of moisture which, carried inland by the frequent passage of cyclones, condenses when it comes in contact with the mountains into abundant rain, exceeding 30 in. per acre, whereas the neighbouring State of Dakota has only 20 in., or even less. On the other hand, these lakes modify the annual variations in temperature. The shore district has an almost maritime climate, with mild winters and cool summers. Towards the interior of the two peninsulas which form the State of Michigan, the contrast between summer and winter becomes more and more marked, the inland counties having a decidedly continental climate. The plentiful, well-distributed rainfall and the differences in temperature make it possible to grow various crops within the State from barley to maize, and from beet to fruit trees. Temperature and precipitation are the weather factors with the greatest influence on the crops.

TEMPERATURE. — Maize is largely grown, but the chance of an abundant and sure harvest decreases rapidly towards the north and the interior because this plant requires a long frost-free season and warm nights during flowering and ripening. When the average temperature is high, the crop

can be harvested 100 to 120 days after sowing, but when the summer is cool, as in the north of the State, at least 120 to 130 days are necessary for complete ripening. In the peninsula between Lakes Superior and Michigan, the frostless season lasts less than 120 days (except along a narrow strip of shore) and the conditions are similar to those of the interior of the northern part of the other peninsula between Lakes Michigan and Huron. Maize-growing is, therefore, impossible in these districts.

Spring cereals (barley and oats) and winter cereals (wheat and rye) do well and give good yields in all the counties. The thick snow protects the seedlings during winter which is much less severe than that of the north-western states. Occasionally, however, alternate freezing and thawing causes damage.

Fruit trees are successfully grown in the Fruit Belt, along the shores of Lake Michigan. The climate there is favourable to fruit trees on account of:— a) a rather cold spring which delays flowering, thus protecting the plants against the effects of late frosts; b) a fine and not too warm summer which gives the fruit flavour and good colours; c) a cool, long autumn, free from frost, allowing the wood to ripen completely and resist the winter without suffering damage.

RAINFALL. — The rain falls chiefly at the period when it is most required, i. e. from May to September, thus favouring the crops. There is a marked correlation between the potato yield and the rainfall of July (1). Thus, in 1916, in the County of Leelanau with 2 in. of rain during this month, 55 cwt. of potatoes were obtained per acre, whereas in the neighbouring county of Kalkaska, where there are only 0.20 in. of rain in July, the potato crop did not exceed 9 1/2 cwt. per acre. Similar results are obtained with maize.

153 — The Effect of Frost on Sugarcane in the Gurdaspur District, India. — BARNES, J. H. in the *Agricultural Research Institute, Pusa, Bulletin* [No 60, pp 55-61 Calcutta, 1918.

In the Gurdaspur district, Punjab, between the 31st and 33rd degrees of northern latitude, and between the rivers Bias, Ravi and Chenab, sugar cane is frequently injured during the ripening period by the frosts of December and January. The paper under review gives the results of research work into the nature and extent of the damage and the means of lessening it.

The degree of ripeness of sugar cane is calculated according to the ratio glucose: saccharose by the formula $x = \frac{\text{percentage of glucose} \times 100}{\text{percentage of saccharose}}$. In the case of unripe cane, which contains little saccharose and relatively much glucose, this formula gives high quotients. As the cane ripens the saccharose increases and the quotient decreases.

From January 6 to 20, 1913, there were sharp frosts. Numerous successive analyses showed that frost interrupts and affects the ripening process so

(1) See R. Oct., 1918, No. 1078 (Ed.)

that the juice contains much glucose and relatively little saccharose. Similar results were obtained in 1913-1914, when frosts occurred from December 26 to 30, January, 9, 22, 26 and 31, February 9, and in 1914-1915, when there were frosts from December 14 to 24, from January 4 to 6, and January 13 and 16. In each case the characteristic poorness in saccharose was observed, though all the varieties of cane studied were not equally affected by cold. They may be divided into four classes:—

1) *Varieties resistant to frost*: — In 1912-1913, Katha; in 1913-1914, Tereru, Dhaulu, Merthi; in 1914-1915, Kanara, Bodi, Merthi, Katha and Dhaulu (these two last were sown in September).

2) *Semi-resistant varieties, Group A* (slowly affected by cold). — In 1912-1913, Tereru, Kansar, Merthi, in 1913-1914, Katha, Kansar, Bodi; in 1914-1915, Katha and Kansar.

3) *Semi-resistant varieties, Group B* (quickly affected by cold but recovering quickly). — In 1912-1913, Kahu, Dhaulu.

4) *Non-resistant varieties* (quickly affected by frost and recovering slowly). — In 1913-1914, Kahu.

In view of the frequency of frosts in the Gurdaspur district during the ripening and harvest periods of sugar cane, the selection and production of types resistant to cold is a very important problem. The local varieties (Katha, Dhaulu, Tereru) which have become completely acclimatised, have, in spite of their probable southern origin, a high resistance to cold. The Kahu variety, introduced fairly recently, resists but little, but in good years it gives such a large crop of such excellent quality that it is worth while risking an almost total loss every three or four years. Selectors should, therefore, attempt to unite in one type the good quality and productivity of Kahu with the resistance to cold of Katha or Tereru.

- 154 - **Studies on Soil Solution, in the United States.** — I BURD, J. S., Water Extractions of Soils as Criteria of their Crop Producing Powers, in the *Journal of Agricultural Research*, Vol. XII, No. 6, pp. 297-309 + 1 Fig. Washington, February 11, 1918. — II STEWART, G. R., Effect of Salinity and Crop Growth in Modifying the Soil Extract, *Ibid.*, pp. 311-368 + 14 Figs. + 1 Plate + Bibliography of 63 Publications. — III HOAGLAND, D. R., The Freezing Point Method as an Index of Variations in the Soil Solution Due to Season and Crop Growth, *Ibid.*, pp. 369-395 + 1 Figs. + Bibliography of 9 Publications. — IV MILLER, C. F., Relation between Biological Activities in the Presence of Various Salts and the Concentration of the Soil Solution in Different Classes of Soil, *Ibid.*, Vol. XIII, No. 1, pp. 213-223.

I. WATER EXTRACTIONS OF SOILS AS CRITERIA OF THEIR CROP-PRODUCING POWERS. — With sunlight, suitable moisture and physical conditions, the limited productivity of a soil may be attributed to the following general causes:— 1) insufficient capacity of the soil to supply the roots continuously with aqueous solutions of the food elements in proper concentrations, 2) the presence of toxic substances, 3) the lack of physiological balance in dissolved soil constituents. It is obvious that one of these conditions alone can decrease production, even if the others are perfectly satisfactory. Limited production due to the second and third causes

is frequent, but of a special nature, and lack of fertility is nearly always attributable to the first.

The author investigated 1) the quantity of nitric and phosphoric acid ions and water-soluble potassium, calcium and magnesium basic ions in good, medium and poor cultivated and uncultivated soils, 2) the quantity of these constituents in barley produced by these soils respectively.

Conclusions. — All the soils examined contained sufficient principal food elements in a water-soluble form to meet the immediate requirements of the crop. This seems to be true generally. This supply of food elements is never completely exhausted in fertile soils, but it appears impossible for a plant to satisfy all its needs if the concentration of individual ions falls below a certain minimum. The optimum concentration, however, varies according to the soil and the physical-chemical system of the soil solution.

The composition of a soil should give some idea of its productivity, but as this depends on three variable factors to which it is impossible to assign definite, relative weights (1. nitric ion content of uncultivated soil; 2. basic ion content of cultivated soil; 3. difference between the basic ion contents of cultivated and uncultivated soils), it is not possible to assign any exact correlation to productivity and the values of these three variables. To obtain an exact measure of the productivity of a soil, its behaviour when cultivated and uncultivated must be studied by subjecting it to a strict control on a chemical basis. This was the method adopted by the author which he considers to be that expressing best the results of the complex activity of the soil either physical, chemical or biological.

II. — EFFECTS OF SEASON AND CROP GROWTH IN MODIFYING THE SOIL EXTRACT. In a review of publications on the water-soluble matter in soil the author points out the contradictory results of the investigations hitherto made. Two points have been insufficiently studied 1) the relation between the amount of soluble food elements in cultivated and uncultivated soils respectively; 2) the relation between the aqueous extract of the soil and its yield. To throw light on these problems the author investigated, during two consecutive years the composition of the aqueous extract of 14 soils of two types — silty clay loam and fine sandy loam. Two galvanized iron containers, capable of holding 1700 lb., were filled with each kind of soil, so that there were two parallel series of 14 cases side by side. During the first year (1915) barley was grown in both series of containers, the second year it was grown in one only, the other being left uncultivated for the purpose of comparison. At intervals samples of 600 gm. were taken from each soil and the aqueous extract prepared.

Results. — There were marked differences in the soluble food element content of the various uncropped soils, whereas, in the 8 cropped soils, both good and poor, this content was practically the same. The three poorest soils contained the least soluble food elements and showed the smallest differences when cropped or uncropped. In all the cropped soils the quantity of water-soluble food elements had greatly decreased when the barley had attained its maximum absorbing power. Comparisons between

cropped and uncropped soils gave valuable indexes of the inherent capacity of the soil to produce nutrients

The composition of the aqueous extract differed greatly in each cropped soil and the corresponding uncropped soil in its content of nitric nitrogen, calcium, magnesium and potassium, but not in its phosphoric acid content which, however, varies greatly in the different soils. An increase in the volume of water used to extract the same weight of soil, i. e., decreased concentration did not modify appreciably the ratio between the quantities of elements extracted.

Conclusions A study of uncropped soils is especially useful for the exact indications it gives of the effects of fallowing and ploughing, which greatly modify the quantity of water-soluble food elements thus justifying the importance formerly attributed to them. It is probable that a two-year rotation alternating with fallow such as practised in California is as advantageous in increasing the water soluble food elements as in the accumulation of moisture in the soil.

III THE FREEZING POINT METHOD AS AN INDEX OF VARIATIONS IN THE SOIL SOLUTION DUE TO SEASON AND CROP GROWTH — The second paper shows the importance of comparing the aqueous extracts of a soil with actual soil solutions the immediate source of the food elements of plants. The author attempted to establish this comparison. As it is almost impossible to obtain an actual soil solution in quantities large enough for research work the author in his determinations of its concentration, used the BOUYOUCOS & MCCOOR method (1), which consist in determining the freezing point in the soil itself under varying moisture conditions. The influence of season moisture cropping and other factors of plant growth on the freezing point of soil was studied in the soils used in STEWART'S investigations (Paper II).

Results In the same soil the concentration of the soil solution varies greatly according to the season the treatment with carbon dioxide, leaching incubation etc. It decreases greatly with the growth of the crop, this effect is still noticeable 8 months after the harvest. Contrary to the hypothesis of WHIMERY and CARRISON soil solutions are not saturated under conditions favourable to the development of the growth of cultivated plants they are even very dilute especially at the height of the growing season. The following observations on the relation between the aqueous extract and the soil solution were made.

The lowering of the freezing point of the soil solution only shows the concentration of the soil solution not the composition of the soluble substances which lower this freezing point. The aqueous extract makes it possible to determine the nature and proportion of these substances. Series of comparisons between the osmotic pressure of soil solutions (determined by its freezing point) and the concentration of the aqueous extracts

(1) BOUYOUCOS and MCCOOR. The Freezing Point Method as a New Means of Measuring the Concentration of the Soil Solution Directly in the Soil, in *Michigan Agricultural Experiment Station, Technical Bulletin* No. 24 pp. 51-67 + 2 plates 1916. (Author)

might give useful data so long as it is borne in mind that the soil solution of one soil may vary greatly. The concentration of a soil solution determined by that of the aqueous extract may be twice to five times as strong as that shown by the lowering of the freezing point of the soil. On the other hand the variations of the soluble food element content of the aqueous extract generally agrees with the changes in the concentration of the soil solution (determined by the variations in its freezing-point). The comparisons made show that the aqueous extract does not contain exclusively the materials found in the soil solution, but also contains others in quantities varying with the conditions of extraction.

IV RELATION BETWEEN BIOLOGICAL ACTIVITIES IN THE PRESENCE OF VARIOUS SALTS AND THE CONCENTRATION OF THE SOIL SOLUTION IN DIFFERENT CLASSES OF SOIL. - Many workers had shown that certain salts which exist naturally in the soil or are added by fertilisers have a marked effect on the bacterial flora. The causes of this effect, attributed to the toxicity of these salts or their osmotic pressure, had not been entirely determined.

To throw light on this subject the author studied the relation between the biological activity (of ammonia-forming bacteria) and the concentration of the soil solution, in three types of soil (sand, sandy loam, clay loam) mixed with different salts. To 100 gm. samples of soil were added 2 gm. of finely ground dried blood and one of the following salts added separately in 13 solutions of graded concentrations between 0.001 and 0.700%.

magnesium sulphate, calcium nitrate, calcium chloride and potassium chloride. In the samples thus treated were determined, first the lowering of the freezing point, then after 4 days' incubation at 30°C, the amount of ammonia formed.

Results. - The effects of the various salts on ammonification differed markedly according to the type of soil to which they were added. In the sandy loam each of the four salts definitely decreased ammonification after a certain quantity had been added (0.064% for magnesium sulphate, calcium chloride and potassium chloride, 0.2% for calcium nitrate), whereas, in clay loam, potassium chloride was the only salt which decreased ammonification.

The effect of the different salts on the osmotic pressure of the solution also varies according to the type of soil. To increase the pressure appreciably in clay loam a larger quantity of each salt was needed than for sandy loam (twice more for calcium nitrate, four times more for potassium chloride and calcium chloride and nineteen times more for magnesium sulphate. The addition of dried blood to the soil also increased the osmotic pressure of the soil solution.

The osmotic pressure at which ammonification begins to decrease also varies greatly in each type of soil (more than 14 atmospheres in sand, 4-6 atmospheres in sandy loam, 9 atmospheres in clay loam) and also with the salt added to the soil, especially in the case of sandy loam.

Conclusions. The effect of the different salts on ammonification appears to vary greatly with the type of soil to which they are added.

As the osmotic pressure at which ammonification begins to decrease is very different in each type of soil and for each salt added, it is probably the chief factor concerned in ammonification.

155 - Investigations into the Formation of Sodium in Soil, in Italy. — DE DOMINICIS, A., in *Le Sperimentali agrarie italiane*, Vol. LI, Pt. 3-6, pp. 103-161, Modena, 1918.

Intensive cropping in arid climates is not only a question of irrigation but is a much more complicated problem, for changes in the composition of the soil caused by high temperature must be taken into account. Contrary to the accepted theory, Prof. ULPANI (1) concluded that the aridity of the climate depends on that of the soil, and that soil aridity is caused by an essentially chemical process - the decomposition of clay into laterite. Unlike clay soils, which are very slightly permeable and hold in their superficial layers much water which may evaporate, laterite soils are very permeable, absorbing water throughout their depth and evaporating none directly and only very little indirectly (by plants). The result is that the atmosphere above these soils becomes drier and drier until the moisture it contains is so little that it cannot condense into clouds, much less into rain. Decreased rainfall thus depends on the decrease in clay; when all the clay has disappeared a desert is formed. This is at least the process characteristic of districts with a low rainfall. In districts with heavy, periodical rains, however, the formation of laterite allows the roots of plants to reach the deep water layers; vegetation thus becomes rank, and gives off by transpiration abundant moisture. The paper under review considers the formation of laterite in the districts with low rainfall in the south of Italy only.

One of the chief problems in laterite soils is that of *soluble salts* which may have an injurious influence on the fertility of the soil, the effects of chemical fertilisers and the results of irrigation. This problem is of great importance in southern Italy where the predominant climate is semi-arid (the dryness of which is connected with the lateritic decomposition of the soil, aggravated or not by the special conditions of the sub-soil), because one of the most common effects of arid or semi-arid climates is the formation of soluble salts in the superficial layers of the soil and the underground waters.

In considering the agricultural regeneration of southern Italy a study must be made of the relations between the distribution of artificial water on the one hand and the distribution and transformation of neutral sodium salts on the other. Irrational irrigation often gives exactly the opposite results to those required - rise of brackish, underground waters, concentra-

(1) According to ULPANI the superficial decomposition of aluminous rocks forms *clay* (colloidal silicate of hydrated aluminium) in cold and cold-temperate climates, and *laterite* (colloidal hydrate of aluminium) in warm and warm-temperate climates. In the second case clay is only an intermediate product produced during the formation of laterite. See on this subject. — R. Dec., 1912, No. 1609; Jan., 1913, No. 14 (Fd)

tion of salts in the superficial soil layers, and the appearance of sodium in place of the corresponding neutral salts. This last effect is the most dangerous because alkaline soils are less capable of sustaining plant life than saline soils. It is true that leaching removes the sodium, but it also removes all the colloidal substances, both mineral and organic, so that such soils do not become fertile, but pass from one form of sterility to another, which is the same thing from an agricultural point of view. It is, therefore, necessary to study the causes determining the formation of sodium before seeking the means of avoiding the danger arising from its removal.

THE FORMATION OF SODIUM IN SOIL — Sodium carbonate may be formed by double decomposition of sodium chloride or sulphate and calcium carbonate, but this is not the most common process in the transformation of saline soils into alkaline soils. For neutral sodium salts to become carbonate by this reaction till the existing calcium carbonate is exhausted, it is necessary (apart from other conditions rarely occurring in soil) that the products of the reaction be constantly eliminated, thus preventing their accumulation on the surface of the soil. Even should this reaction take place, the soil may lose its lime more or less completely, and it has been proved that soils in arid climates are often poor in calcium carbonate even though they lie on calcareous substrata. This fact is in opposition to HILGARD's theory, according to which natural sodium is formed by a reaction between calcium carbonate and sodium sulphate or chloride in the presence of large quantities of carbonic acid. This theory is also contradicted by yet more fundamental facts — the presence of sodium chloride and sulphate in soil absolutely prevents the formation of sodium, which only occurs when the corresponding neutral salts are eliminated and is present in quantities which increase as this elimination becomes more complete. Moreover, sodium may appear in soil even when calcium carbonate is completely absent.

Alkaline soils usually result from saline soils, but only indirectly so, because for this transformation to take place the neutral sodium salts must be exhausted. GEDROIZ proposed the following explanation of this phenomenon:— sodium chloride and sulphate in soil cause the formation of special compounds which can react only in the absence of the salts from which they are derived. These compounds are formed by the double decomposition of the absorbing compounds of calcium and magnesium on the one hand, and sodium chloride or sulphate on the other. The production of sodium becomes all the more abundant as the preceding action of the neutral salts is more prolonged and intense and the content in absorbed sodium which may be removed by 10 % hydrochloric acid, independently of the total sodium (which includes that forming part of the silicate molecule) is greater.

The results of the author's experiments make it possible to interpret the mechanism of the reaction in quite a different way. Sodium is not formed by the double decomposition of the absorption compounds of sodium in the dispersion stage and calcium carbonate. Alkalinity is, at the beginning, derived from the sodium absorption compounds, but it is produced simply

by hydrolysis of these compounds when they leave the coagulated state. The sodium hydrate resulting from the hydrolysis may subsequently react on the calcium carbonate, but more often it turns to carbonate under the action of the carbonic acid. Alkalinity occurs even in the absence of both calcium carbonate and carbonic acid. The action of neutral sodium salts which inhibit the formation of alkalinity does not agree with that described by GEDROIZ. The absorption compounds of sodium cannot dissociate in the coagulated state but tend to pass into solution. Strong electrolytes, such as chloride and sulphate of sodium or potassium, maintain them in the coagulated, non-dissociable state in which the corresponding hydrate cannot form. GEDROIZ admitted that the absorption compounds are dissociable even in the coagulated state, and that the basic reaction resulting from this dissociation caused them to pass into solution, thus enabling them to react with calcium carbonate, especially in the presence of carbonic acid. In this case sodium chloride and sulphate would, by their sodium ion, prevent dissociation and, consequently, the basic reaction required for the absorption compounds to pass into the "sol" state.

ACTION OF GYPSUM USED AS A FERTILISER IN ALKALINE SOILS — This action does not consist solely in neutralising the sodium. The calcium carbonate formed (especially if it changes to bicarbonate) together with gypsum used in excess and made more active by the neutral sodium salts, coagulates the colloids and changes them back to absorption compounds of calcium. The neutral sodium salts themselves may aid favourably the elimination of alkalinity, but indirectly, and through their respective anions. This is shown by the different actions of various salts. "Hydrogels" which have not yet passed to the "hydrosol" state and are perhaps not of the same nature as "hydrosols," may, by absorbing the cation of the salts concerned, set free their anions, which then neutralise the alkaline compounds. This phenomenon does not occur if the mass of soil is separated from the alkaline liquid, because by so doing the "hydrogels" it contains are removed.

EFFECT OF IRRIGATION WITH BRACKISH WATER. — The irrigation proposed by the Italian Royal Commission of Irrigation is dangerous to the soil because it tends to form absorption compounds of sodium. This danger might be avoided if gypsum be added, because calcium sulphate (gypsum), made more soluble by the presence of sodium salts, prevents the formation of sodium absorption compounds. If salt soil mixed with gypsum is washed with fresh water, sodium is not formed.

NATURE OF THE COLLOIDS CONCERNED IN THE FORMATION OF SODIUM. — The whole of the *mineral* colloid does not take part in this process: only the colloids of a zeolitic type capable of absorbing by double decomposition. If the zeolitoids are subjected to a treatment which changes them into compounds incapable of absorbing by double decomposition, the production of sodium is reduced to a minimum. The "chabasitic" type (similar to chabasite) of zeolitoid which corresponds in structure to a silico-aluminate, is the one which takes the most active part in the formation of sodium because, in this type, the substitution of the metal is very rapid and

dissociation easier. In the "natrolitic" type (similar to natrolite) with a structure corresponding to that of a double silicate, the substitution of the metal is very slow and dissociation more difficult. On the other hand organic compounds are also concerned in the formation of sodium in the soil, this formation being decreased by the destruction of the organic matter of the soil. The most important of these compounds are the humines and ulmines which, like the zeolitoids, absorb by double decomposition. Humic and ulmic acids are, however, not concerned; they act like the mineral compounds which can no longer absorb by double decomposition but can only form salts with free bases.

156 - Inorganic Composition of a Peat and of the Plant from Which it was Formed, in Florida, U. S. A. — MILLER, C. F., in the *Journal of Agricultural Research*, Vol. XIII, No. 12, pp. 605-609, Washington, June 17, 1918.

The chemical composition of peat and that of the plants from which it is derived have rarely been compared. The author examined a Florida peat and saw grass (*Cladium effusum*) from which it was formed. Admitting the silica content to remain constant during the transformation of the plant into peat, it may be assumed that 7 parts of the plant give 1 part of peat, the losses in mineral constituents being respectively: — 12 % of iron and aluminium, 24 % of calcium, 41 % of magnesium, 96 % of potassium, 84 % of sodium, 70 % of phosphoric acid, 33 % of nitrogen. Compared with these the losses occurring during the transformation of granite and limestone into arable land are: — greater for ferric oxide, aluminium, calcium and magnesium, less for potassium, about equal for sodium, nil for nitrogen.

157 Availability of Potash in Some Common Soil forming Minerals and Effect of Lime upon Potash Absorption by Different Crops. — PLUMMER, J. K., in the *Journal of Agricultural Research*, Vol. XIV, No. 8, pp. 297-315 + 10 Tables + 1 Plate + 1 Fig. + Bibliography of 11 Publications, Washington, August 19, 1918.

The data on the availability of potash in the common soil-forming minerals are contradictory, having been obtained in part from treatment with weak solvents and in part from an optical examination of these minerals after many years of weathering. The only four minerals containing potash in the fine sand and silt of the United States' soils are biotite, muscovite, orthoclase and microcline. These differ little as regards the solubility of their potash in fresh water, but biotite and muscovite give up much more of their potash to carbonic acid solutions than do orthoclase or microcline. Lime as calcium bicarbonate does not increase the solubility of the potash in any of these minerals.

Pot experiments showed oats, soybean, rye and cowpea to absorb different amounts of potash from these minerals. For example, the increase in the dry matter of oats after the addition of biotite is four times that produced by microcline and 66 % as much as that produced by potassium sulphate. Muscovite gives nearly twice as much dry matter as orthoclase. Similar results were obtained with rye. Precipitated calcium carbonate alone did not appreciably increase the dry matter or the potash removed from the soil by oats and rye. When this calcium carbonate was used in

conjunction with biotite the dry matter of the soybean was increased by about 33 % ; when applied with muscovite it caused a larger increase of growth than when applied with orthoclase or microcline.

Lime caused soybeans and cowpeas to extract more potash from soils treated with potassium sulphate, biotite and muscovite. This may be attributed to the formation in the soil of conditions more favourable to plant growth, and not necessarily to the solubility of the potash. The addition of lime did not appear to increase the solubility of the potash (in N/5 nitric acid) in soils to which the minerals had been added.

After two years' cropping, N/5 nitric acid removed more potash from the pots which had been treated with biotite and muscovite than from the control pots, whereas no difference was observed where orthoclase and microcline had been added.

158 - **The Inversion of Cane Sugar by Soils and Allied Substances and the Nature of Soil Acidity.** — RICE, F E and OSUGI, S, in *Soil Science*, Vol V, No 5 pp 333-358 + Bibliography of 105 Publications. Baltimore, May, 1918

Early investigators into the inversion of saccharose attributed it to the catalysing action of the hydrogen ions exclusive of any other inorganic substance. Later TACKER, SUCHTING and HANLEY showed it might be caused also by the soil, the organic matter of which was the principal factor. The authors show that inversion must also be attributed largely to the mineral constituents of the soil. There is no doubt that inversion caused by soil is due to acid which may be present in four different forms :—

1) Some soils may contain a small quantity of acid soluble in sugar solutions. The greater part of the acid is, however, bound to the soil particles in the following two forms :—

2) Acids in themselves easily soluble but strongly adsorbed on the surface of the soil particles.

3) Insoluble acid, such as silicic acid.

4) There may be in the soil solution a small quantity of a neutral salt which may be broken down by the action of the soil mass so that, the base being more strongly adsorbed than the acid, this is left free to invert the saccharose.

The following observations prove the inverting action of soil to be due to insoluble acids :—

1) Many soils invert saccharose in a solution which remains neutral during contact, or sometimes becomes alkaline. A soil which has been made to adsorb a base and then digested with a saccharose solution may show inverting action and also give up sufficient base to the solution to make it alkaline.

2) Aqueous soil extracts have little, or no inverting power.

3) In a sugar solution placed in contact with a soil, inversion does not continue after the soil has been removed.

4) Inversion increases with the amount of soil in contact with the sugar solution when there is no measurable change in the hydrogen ion concentration of the solution.

5) Inversion is stronger if the soil is shaken with a sugar solution than if the mixture is allowed to stand.

6) Prolonged and repeated extractions of soil with water and sugar solutions do not decrease their inverting power.

Fullers' earth, cotton, charcoal, and other substances to which an action similar to that of acid soils has been attributed do not invert cane sugar. Certain soluble acids so strongly adsorbed by solids that they can no longer be removed in measurable quantity by washing can yet invert sugar. Certain powdered silicates may show inverting power when their aqueous extract is treated with a direct current; their base is split off, dissolves, and accumulates at the cathode, the insoluble silicic acid remaining with the mass in suspension. Acidity increases in soils thus treated. Contrary to the conclusions of previous workers, the hydrates of lead, copper, bismuth, aluminium, iron and zinc were not found to possess inverting power. Many solids which have no inverting power when alone may, when in suspension in the presence of a neutral salt, show inverting power due to selective adsorption of the base which sets free a small quantity of acid.

A soil is generally called "acid" when its infertility may be corrected by the addition of a base, such as lime. Many factors cause this condition in soils, the presence of a real acid being only one of them. The methods used to detect or determine "soil acidity" do not, as a rule, measure the acid present but may depend on many properties in no way related to acidity. The catalysing power of a soil, shown by the inversion of saccharose does however, give a measure of the acidity of the soil. The authors believe this is probably the only true basis of a method for determining acidity bound up with the solid phase of the soil. The outlines of such a method are given: — 5 or 10 gm. of the soil to be examined + 50 cc. of a 5 % saccharose solution are digested over the hot water bath at 80 to 87° C. for 1 ½ to 3 hours. The sugar in the filtrate is then estimated by the titration method described by S. W. COLE in his book, "*Physiological Chemistry*", 1908 edition, p. 44

159 - Influence of Soil Reaction on the Development of Nitrogen-fixing Bacteria; Investigations in the United States. — I GAINFY, P. L., Soil Reaction and the Growth of *Azotobacter*, in the *Journal of Agricultural Research* Vol XIV, No. 7, pp 265-271. Washington, August 12, 1918. — II FRED, E. B. and DAVENPORT, A., Influence of Reaction on Nitrogen-assimilating Bacteria, *Ibid*, Vol. XIV, No. 8, pp 317-336 + 1 Fig + Bibliography on 26 Publications Washington, August 19, 1918

I. — In 74 water cultures of *Azotobacter chroococcum*, prepared by inoculating a nutrient solution with suspensions of various soils were determined, after three weeks' incubation, the development of the bacteria and the nitrogen fixation. The hydrogen ion concentration (P_H) (1), i. e. the reaction, of the soils used was also determined. This reaction gave im-

(1) This index, used merely to simplify, really means that the hydrogen ion concentration of the aqueous extract is equal to $\frac{1}{10^{6.8}}$ or to $10^{-6.8}$, which corresponds to an acid reaction. Perfect neutrality is expressed by the index 7, alkalinity by figures above 7, and

portant results:— All the soils containing no *Azotobacter*, except three, gave a P_H equal to or below 5.9. All the soils containing *Azotobacter*, except three, gave a P_H of 6.0 or more. The averages obtained were, for the first: — $P_H = 5.71$, nitrogen fixed per culture, 3.88 mgm; for the second: — $P_H = 6.78$ nitrogen fixed per culture, 8.11 mgm. The reactions were determined in soils kept from 7 to 10 months which, according to GILLESPIE, may cause variations in the soil conditions.

The author does not pretend that the maximum acidity tolerated by *Azotobacter* is necessarily represented by a P_H of 6. Experiments now in progress enable him to state that this bacterium does not exist in the active state in soils the hydrogen ion concentration of which exceeds a limit which he hopes to be able to define. He is also studying this phenomenon in connection with other soil bacteria.

II. — Many investigations have shown soil reaction to have an important effect on the growth of Leguminosae and the bacteria of their root nodules, and the effect of acidity or alkalinity on both has been observed in a general way without obtaining exact information on the reaction favouring the growth of the bacteria without the host plant.

To solve this problem the author studied the action of 21 varieties of *Rhizobium leguminosarum* from different Leguminosae, and 2 varieties of *Azotobacter* with respect to acids and alkalis. Numerous parallel cultures of these bacteria were made by inoculating them into 50 cc. of a mannitol solution in a 200 cc. capacity Erlenmeyer flask, modifying the reaction of the medium by the addition of sulphuric acid or caustic soda. After incubation during one month at 28°C. the number of bacteria was determined by plate counts, microscopic preparations and mannitol-agar inoculations. In addition to the total acidity or alkalinity, the hydrogen ion concentration was determined colorimetrically.

Results. — The action of *Rhizobium* and *Azotobacter* with respect to small quantities of acid or alkali depends on many factors, but chiefly on the nature of the medium and the dissociation of the acid or alkali. All the results showed that *Rhizobium*, no matter what its origin, does not live long in a medium the reaction of which prevents its reproduction. On the whole, the 21 varieties of *Rhizobium* used had similar cultural characters, the greatest difference being that some varieties grew more rapidly than others. In ordinary culture media *Rhizobium* showed no peculiar growth characteristic.

The addition of sulphuric acid to the culture solutions proved much more injurious to bacteria from alfalfa than to those from lupin. In other words, nodule bacteria from different plants behave differently towards acid. They may be divided into five groups according to the "critical

acidity by figures below 7, a decrease in the index showing an increase in the hydrogen ion concentration, the presence of which in the free state determines the acidity of the medium. This is called "SORENSEN'S index" because, in 1909, this worker proposed to use it as an index of the reaction of solution. It is usually represented by one of the symbols P_H , p_H , or P_{H^+} — Cf. McCLENDON, J. F., *Physical Chemistry of Vital Phenomena*, Princeton, 1917. (Ed.)

point" or degree of acidity intermediate to that allowing growth and that inhibiting it:—

1) Critical point	$P_H = 4.0$	Alfalfa and sweet clover
2) " "	$P_H = 1.7$	Garden pea, field pea, and vetch
3) " "	$P_H = 4.2$	Red clover and common beans
4) " "	$P_H = 3.3$	Soybeans and velvet beans
5) " "	$P_H = 3.15$	Lupins

It is thus seen that alfalfa bacteria are the most sensitive to acidity and lupin bacteria the least sensitive.

160 - Effect of Nitrifying Bacteria on the Solubility of Tricalcium Phosphate.—

KELLEY, W. P., in the *Journal of Agricultural Research*, Vol. XII, No. 10, pp. 671-683 + Bibliography of 9 Publications. Washington, March 11, 1918

According to HOPKINS and WHITING, the nitrites formed in soil by nitrifying bacteria (*Nitrosomonas* sp.) are of great importance in the dissolving of calcium phosphate in soil. DAVENPORT holds that the importance of such bacteria as agents in dissolving tri-calcium phosphate is equal to that of bacteria of Leguminosae in the fixation of nitrogen. Since the formation of nitrous acid is a necessary stage in the process of nitrification the author studied this phenomenon in soil and sand cultures by observing the formation of nitrates and the solubility of the calcium and phosphoric acid in water, as indices of the biochemical activity of the nitrifying bacteria. For the soil cultures was used a sandy loam of granitic origin containing 25 millionths of soluble calcium and 17 millionths of soluble phosphoric acid.

RESULTS. — The addition of tri-calcium phosphate slightly increased the solubility of these constituents whereas the addition of ammonium sulphate immediately raised the content of soluble calcium to 90 millionths. This ammonium sulphate nitrifies fairly rapidly, with the result that the calcium content eventually exceeded 200 millionths. The nitrification of the ammonium sulphate in the presence of calcium carbonate did not increase the solubility of the soil phosphates or of the tri-calcium phosphate added, whereas, in the absence of calcium carbonate, 0.156 lb. were dissolved for every pound of nitrogen oxidised. This quantity is much less than that found by HOPKINS and WHITING in water cultures of nitrifying bacteria containing ammonium sulphate and tri-calcium phosphate. These workers found that 2 lb. were dissolved for every pound of nitrogen oxidised. In soil the acid formed seems to decompose the carbonate rather than the calcium phosphate.

CONCLUSIONS — These cultural experiments show that, in both sandy loam and silicious sand, the nitrification of the organic nitrogen (e. g. dried blood) does not increase the solubility of tri-calcium phosphate under field conditions favourable to the growth of the cultures. It is, however, possible that nitrification of ammonium sulphate causes the solution of small quantities of tri-calcium phosphate in soils poor in lime. Although nitrifying bacteria may dissolve tri-calcium phosphate under given conditions, they are not powerful agents. These conclusions must not be interpreted

as being opposed to the use of crude rock phosphate as a fertiliser. Although the means by which tri-calcium phosphate is made soluble in soil have not yet been definitely determined, there is no doubt that, in many districts, crude phosphate has a beneficial effect on the crops.

- 161 - **The Production of Carbon Dioxide by Moulds Inoculated into Sterile Soil; Experiments in Java.** — POTTER, R. S. and SNYDER, R. S., in *Soil Science*, Vol. V, No. 5, pp. 359-375 + 4 Figs. + 1 Table + Bibliography of 4 Publications. Baltimore, May, 1918.

Typical soil moulds were inoculated into sterilised clay loam. They grew with a vigour almost equal to that produced by inoculation with the whole soil flora in soil emulsions. Growth was measured by the evolution of carbon dioxide. It was also found that the lime of the soil had no effect on the growth of the moulds. The soil inoculated was sterilised by two methods. By the first the soil was heated for $3\frac{1}{2}$ hours in the autoclave three successive times at intervals of 48 hours. This treatment increased the content in nitric, ammoniacal and soluble non-protein nitrogen. By the second method the soil was heated to 90°C in a steam current for 1 hour and 40 minutes six times successively every other day. This method increased the content in ammoniacal and soluble non-protein nitrogen, but decreased the nitric nitrogen content. The moulds caused a decrease in nitric nitrogen in every case and in soluble non-protein nitrogen in nearly every case. The ammoniacal nitrogen content hardly varied.

These investigations, made with *Mucor*, *Rhizopus*, *Aspergillus niger*, *Trichoderma*, *Chaetomium*, as well as with soil emulsions, give no definite solution of the problem of the activity of moulds in normal soils. The fact that, in nearly every case, carbon dioxide is set free in sterilised soils inoculated with moulds or soil emulsions does, however, seem to show that moulds are active.

- 162 - **The Relative "Rawness" of Some Humid Subsoils, in Minnesota, U. S. A.** — HARMER, P. M., in *Soil Science*, Vol. V, No. 5, pp. 393-401 + 1 Fig. + 1 Plate + Bibliography of 4 Publications. Baltimore, May, 1918.

The vegetation experiments described were undertaken to determine whether the subsoil of humid districts are really "raw" (infertile), as is usually admitted, unlike the subsoil of arid districts, which HILGARD considered productive. From seven Minnesota glacial soils (three prairies with very calcareous subsoil, and four forests with slightly calcareous subsoil) were taken samples of soil to depth of $1\frac{1}{2}$ ft. and subsoil at a depth of 3 ft. This soil was placed in galvanised iron pots and kept in a greenhouse, where alfalfa plants with nodules adhering to the roots were planted in them. The plants were weighed and the results obtained compared.

Results. — Two of the forest subsoils, poor in lime, were as productive as the two corresponding soils and five other soils. In the five other subsoils (2 forest and 3 prairie) the alfalfa yield was only $\frac{1}{6}$ to $\frac{1}{2}$ of that obtained in the corresponding soils. In the two fertile subsoils the nitrogen content was not higher than in the five infertile subsoils.

Conclusions. — In Minnesota State, where the soil is humid, some of the glacial subsoils produce alfalfa as well as the soils, if inoculation is as-

sured. Other subsoils are quite unproductive though the cause can be attributed to neither a low nitrogen content nor lack of carbonates.

- 163 - **Chemical Criteria, Crop Production and Physical Classification in Two Soil Classes, in California, U. S. A.** — BURD, J. S., in *Soil Science*, Vol V, No 5, pp 405-419 + Bibliography of 8 Publications. Baltimore, May, 1918

Fourteen soils, 6 silty clay loams and 8 fine sandy loams were subjected to a) mechanical analysis, b) chemical analysis by different methods (complete or fusion with alkalis, extraction with hydrochloric acid [sp. gr. 1.115], extraction with 1 % citric acid, and extraction with water), c) cultural experiments under controlled conditions. The relation between the analytical results and the productivity of the soils was then determined.

CONCLUSIONS. — Water extraction and, to a lesser extent 1 % citric acid extraction gave data agreeing generally with the productivity of soil. Complete chemical analysis and hydrochloric acid extraction do not give a measure of the present productivity of a soil or of the probable duration of this productivity except in the case of very silicious soils.

Different soils of the same physical type differed so much in the composition of their water extracts and in the yield of the plant tested (barley) that physical classification alone cannot be considered an adequate means of determining the probable productivity of the soils or their fertiliser requirement. It can only be used to determine the general methods of mechanical treatment. If physical classification is to be of real use it must be completed by data on the growth of the preceding crops, or, better still, by the application of chemical and biological criteria to each soil. These criteria should be the most important factors in every thorough study of the soils unless the soils examined differ widely in physical and chemical composition.

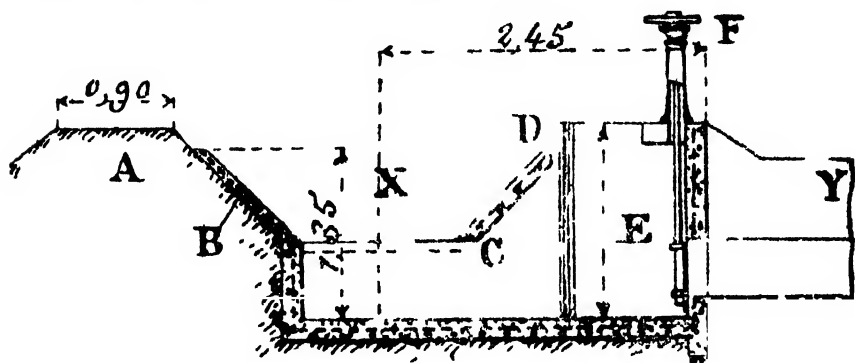
- 164 - **"Red Soil" and "Grey Soil" of Indo-China and their Suitability to the Cultivation of Rubber.** — See No 205 of this *Review*

- 165 - **Turnout in High Velocity Canal, in Utah, U. S. A.** — LYTEL, T., in *Engineering News Record*, Vol LXXXI, No 12, pp 545-546 + 9 figs. New York, September, 19, 1918

A description is given of the method adopted by the U. S. Reclamation Service in Utah to divert water from a high velocity canal into a lateral canal without affecting the flow appreciably. The canal from which the water is diverted is itself one of several laterals of a large irrigation canal supplying about 65 miles of laterals and sublaterals. Many of these canals are built on steep slopes, and the one from which the water is diverted has a velocity of from 15 to 30 ft. per second.

The means adopted to divert the water without disturbing the flow are shown in the figure. The slopes *AB* and *CD* of the first canal, lined with reinforced concrete, are not continuous, so that the water moving between *XY* is held there and continues its flow without disturbance. In the bottom of the canal is a rectangular opening through which the water passes to the lateral *Y*. The passage of the water is adjusted by a valve *E*, controlled by a fly wheel *F*. This arrangement of the slopes *AB* and *CD* pre-

vents splashing or unusual movement in any place. Turnouts of this type have been used for several irrigation seasons and have always given excellent results at any stage of flow of the lateral.



Turnout device

166 - New Experiments on the Use of Electricity in Agriculture in Argentina.

— TRIVIERI H. M. in *Le Cent Rural* Vol. XI N. 86 87 p. 16. P. 115, 118.

A series of investigations led the author to study the use of barbed wire or artificial bramble as earthing for lightning conductors and anti-hail apparatuses. The results, which were in perfect agreement with those on the study of oscillating electric discharges. From 1911 to 1912 the author undertook in the province of Mendoza, Argentina, very successful experiments on the use of electricity with anti-hail apparatuses which had to be stopped for financial reasons. He, however, continued his investigations and made tests of the diffusion in vegetable mould by artificial bramble of very weak, but very frequent oscillating discharges derived from a variation of the electric charge of the atmosphere immediately above the crops.

In November, 1917, the author installed an electro-cultural device in a maize field at Maximó Piz. The field chosen, $11 \times 262\frac{1}{2}$ ft. was divided into two parts, one $197 \times 262\frac{1}{2}$ ft. the other $131 \times 262\frac{1}{2}$ ft., used as a control. The air and light conditions were the same over the whole field. To test thoroughly the fertilising action of the points in the soil the experimental field was divided into three plots. Plot 1 received the electricity from small brushes on wooden poles $7\frac{1}{2}$ ft. high and distributed it to barbed wire placed at 4 inches below the soil throughout the $262\frac{1}{2}$ ft. of the plot. Plots 2 and 3 had on the contrary artificial bramble on the top of the poles and $6\frac{1}{2}$ ft. earthing on either side of each.

Results. Plot 1, 925.8 lb. of grain (maize), Plot 2, 775.9, Plot 3, 705.3. Control plots 4 and 5, 484.9 lb. As compared with the control the increases were therefore, 87%, 56% and 47%, i.e. an average of 63.4%.

It seems, therefore, clear that the electricity diffused through the soil was the principal factor in these increases. The maize stems were also higher and much stronger. These tests confirm the author's hypothesis as

to the value of artificial bramble as earthings for lightening conductors; their use would protect the houses and even the movables, in the country. These experiments show the possibility of protecting from hail large districts which suffer greatly from it, at (in normal times) a relatively small cost.

167 - **Clean Weeding in Rubber Plantations.** — See No. 205 of this *Review*.

168 - **Goat's Rue as Green Manure and Fodder Plant.** — LA MARCA, F., in *Le Stazioni Sperimentali agricole italiane*, Vol. LI, Pt. 3-6, pp. 167-191 + Bibliography of 20 Publications. Modena 1918.

A few years ago the author drew the attention of farmers in the south of Italy to goat's rue (*Galega officinalis*), an excellent Leguminous plant, for use as green manure. It grows rapidly and, unlike other Leguminosae, may be grown consecutive years. In many parts of the south the free pasturing of animals after the wheat harvest makes a larger cultivation of green manure crops difficult. Goat's rue, which stock do not like, may be advantageously sown in wheat fields and is very beneficial to the soil. The fertility of the lower Liri valley, especially in Aquinate is due to this practice, which is very ancient there. It might also be introduced into Tavoliera of Apulia, Calabria, and Sicily.

This plant may be sown in autumn or spring at the rate of 13 to 18 lb. per acre, after hoeing. After the first summer-autumn rains, after the harvest, it grows and, before winter, is from 24 to 31 inches high, forming a regular carpet which is easy to plough under. At the first autumn frosts the abundant green part of the plant dries up and decays on the moist soil. In view of the increasing need of a greater production of fodder crops, the author asks whether it would not be possible to use it as fodder.

Before goat's rue is fully developed, and especially when mixed with other fodder, it is accepted by animals, but when fully grown or in flower, i. e. when the green parts have acquired their characteristic bitter taste, it is invariably refused by cattle, sheep and horses. BIANCHIARD, MOUSSU and S. BRÉLER have shown that goat's rue has caused numerous cases of poisoning followed by death in sheep. In 1898-1899, Prof. PASQUALINI grew goat's rue in the Forlì, Romagna, district and made different fertilising tests with it. He obtained very high yields (13.9 tons of grass per acre in 2 crops a year), and observed that, as a result of cultivation, the roughness of the plant and its bitter taste had disappeared and that it was much relished by cattle, sheep and horses. This shows the possibility of obtaining by cultivation improved varieties without the bitter flavour.

Ensilaged goat's rue is accepted by sheep and gives rise to no disorders.

169 - **The Storage of Sulphate of Ammonia on Farms.** — *The Journal of the Board of Agriculture*, Vol. XXV, No. 6, pp. 703-705. London, September, 1918

Ammonium sulphate may be preserved in sacks or loose in a heap. In either case the building in which it is stored should be dry and free from dampness. When kept in sacks they should be piled on a platform raised about 6 in. from the ground so that the air can circulate freely. Should there

be any difficulty in constructing a platform the sacks should be piled on one or more layers of hurdles. Before building the platform the floor should be covered to a depth of about 3 in., with a dry substance which will absorb any moisture which may drain off from the sacks. The best substances for this purpose under ordinary conditions are castor meal, rape meal or raw bone meal as they can afterwards be used as fertilisers. If these substances are too expensive, as at the present time, dry earth, sand, peat moss, or sawdust may be used. It is not advisable to use superphosphate, and on no account should chalk, lime, or basic slag be used as they set free the ammonia. If free from all dampness ammonium sulphate keeps very well without losing any of its fertilising power. Farmers should, wherever possible, purchase "neutral" ammonium sulphate (containing less than 0.025 % of free acid) because this quality does not rot the bags as do those containing more free acid. It is for this reason that many farmers empty the sacks as soon as they receive them and keep the fertiliser in heaps.

This second method calls for the same precautions as the first.

If the ammonium sulphate is lumpy, it should be broken up and passed through a $\frac{1}{4}$ in. riddle before use. "Neutral" ammonium sulphate does not cake, but remains free, like sand.

170 - Ammonico-potassic Nitrate, a New Fertiliser for Sugar Beets. — HOFFMANN, M., in *Die Deutsch. Zuckerindustrie*, Vol. XLIII, No. 10, pp. 149-150. Berlin, May, 1918.

Since 1917 experiments have been made in Germany on small plots, in the use, as a fertiliser for beets, of ammonico-potassic nitrate, obtained at the "Badische Anilin- und Sodafabrik" by treatment and double decomposition of ammonium nitrate with potassium chloride. The fertiliser, also known as "mixed salt" ("Mischsalz"), is granular, brownish-grey, spreads easily, and contains 13 % of nitrogen, 25 % of potassium, 3 to 4 % of water, and 27 to 30 % of chlorine.

This compound may be safely used as a fertiliser. It is preferable to ammonium sulphate as it spreads more evenly, absorbs less moisture, and is less explosive. Experiments made by Prof. SCHNEIDFELD on beets in the sandy loam of the Lauchstädt Experiment Station, showed the value of the new fertiliser to be exactly equal to an equivalent quantity of sodium nitrate. The makers also intend putting on the market ammonico-sodium nitrate. The ammonium chloride put on the German market in 1918 contains from 23 to 25 % of nitrogen and is as satisfactory as ammonium sulphate. It should, however, be used with care when added to plants sensitive to chlorine.

171 - The Use of Commercial Bacterial Cultures for Inoculating Leguminosae. — I. FILLERS, C. R., Report on the Examination of Commercial Cultures of Legume-infecting Bacteria, in *Soil Science*, Vol. VI, No. 1, pp. 53-67 + Bibliography of 10 Publications. Baltimore, July, 1918 — II. NOYES, H. A. and CROMER, C. O., Tests of Commercial Cultures for Legume Inoculation, *Ibid.*, pp. 69-77 + Bibliography of 5 Publications.

I. — REPORT ON THE EXAMINATION OF COMMERCIAL CULTURES OF LEGUME-INFECTING BACTERIA. — The author examined 32 official and 20

unofficial samples of these cultures to determine their nature, purity, and value. The medium used for the microscopic examination consisted of 15 gm. of purified agar diluted with 1 litre of distilled water containing 12 gm. of mannite, 2 gm. of mono-potassium phosphate, 0.2 gm. of magnesium sulphate, 0.2 gm. of sodium chloride, 0.1 gm. of calcium sulphate, and 1 gm. of calcium carbonate. This medium proved very satisfactory for microscopic preparations of all strains of *B. radicola*.

Results. — The general condition and purity of the official samples were, on the whole, good; only two were classed as "poor" and four as "partly poor". Soybeans were harder to inoculate with commercial cultures than most of the other Leguminosae tested, and it is advisable to inoculate this plant with soil from fields in which it has previously been grown. Soil or muck cultures are excellent carriers of Leguminosae bacteria. The plate test gives a good indication of the infecting capacity of the bacteria, but the results obtained should be controlled by the cultivation of Leguminosae, and the examination of their roots for characteristic nodules.

II. — TESTS OF COMMERCIAL CULTURES FOR LEGUME INOCULATION. — The object of these tests was: - 1) to compare the efficiency of commercial bacterial cultures with that of soil taken from fields in which Leguminosae are grown, each seed receiving a definite proportion of either the commercial culture or the bacteria in the weight of soil used per acre; 2) to compare the effects of inoculation with 1 lb. of soil per acre and those of inoculation with $\frac{1}{2}$ lb. of soil per acre; 3) to determine the effect of fertilisation on inoculation.

Results. — With sweet clover commercial bacterial cultures and soil cultures applied in equivalent quantities gave satisfactory and identical results (100 % of inoculation). With soybeans, cowpeas and hairy vetch, however, neither of these inoculation methods gave good results. Double inoculation (1 lb. per acre) had no more effect than simple inoculation ($\frac{1}{2}$ lb. per acre). A double dose of commercial bacterial culture applied to soybeans in a greenhouse gave an average of 75 % of inoculation as compared with 20 % in the controls. Fertilisation with sodium nitrate tended to decrease the percentage of inoculation. To obtain satisfactory inoculation larger quantities of soil or commercial bacterial cultures should be used than was the case in the experiments.

172 - **Bamboos and their Geographical Distribution in Africa.** — RIVIERE, C, in the *Bulletin de la Société Nat. d'Acclimatation*, Year LXXV, No 12, pp 370-372 Paris, December, 1918

The term "African continent" excludes the large islands of Madagascar, Bourbon, Mauritius, etc., which, by their geological and botanical characteristics belong rather to Asia. Of the 500 species of bamboos known Africa only possesses very few, including only one medium sized species as compared with the large Asiatic forms; all the rest are small, sometimes dwarf, especially in the genus *Puelia*.

The most important species is the ancient *Bambusa abyssinica* A.

Richard (*Oxythenanthera abyssinica* Munro), which is in reality *Bambusa arundinacea* Retz, an Asiatic species. In favourable environment, in many different places, near the streams in the plains, or at high altitudes where the cold is often sharp, this African bamboo grows big and its foliage is thick, often impenetrable. No bamboos grow in the north of Africa. The plant cannot resist the Sahara climate and stops at the border of the savannas. A small species, *Arundinaria tessellata* Munroe, grows as far down as the Cape.

The large African bamboo is much used but less so than in Asia. The inhabitants use it for building their huts and making tools and sometimes eat the seed or use it as fodder for their stock.

- 173 - **Acer Guyoti** Beauverd, a Hybrid Maple Found in Upper Savoy, France. — BEAUVERD G. in the *Bulletin de la Société Botanique de Genève* Series 2 Vol. X Nos. 1-3 pp. 11-12 Geneva 1918.

This plant, discovered by the author and M. H. Guyot at La Tournette, Upper Savoy, in the upper part of the Nantets valley (at 4,600 ft.) is doubtless derived from a cross between *Acer campestre* L. and *A. Opulus* var. *opulifolium*. In spite of the absence of flowers the hybrid nature of the plant is seen from its leaves. On the same branch are sometimes seen the two types, *A. campestre* and *A. Opulus* accompanied by numerous exactly intermediate leaves. The author proposes to call this hybrid *Acer Guyoti* Beauverd.

- 174 **Investigations into the Leaf Glands of the Peach and their Relation to the Constitution of the Flower** (1). — CAMPBELL C. in *Atti della Reale Accademia dei Lincei* *Serie quinta Rendiconti Classe di Scienze fisiche matematiche e naturali* Vol. XXVIII 1st Half Year pp. 41-413 Rome 1918.

The peach tree is known to have two forms of leaf glands: *globular* and *reniform*. CAMPBELL showed that both these forms may occur on the

(1) SCIENTIA 1915 No. 386, the summary of a previous note by the author on the floral biology of the peach tree in which the distinctive characters of this species are described in such a way as to form a reliable and rational basis for classification as well as for further work on improvement and genetics. The author indicates similarities of the almond tree (*Atti della Reale Accademia dei Lincei* 1st Half-Year Pl. I pp. 256-261 + 1 figs. Rome 1915). The colour of the sepals and the petals varies greatly. There seems no correlation between their size and colour on the one hand and the characters of the reproductive organs and the quality of the fruit on the other. The floral forms are distinguished by the position of the pistil with respect to the stamens—long style intermediate style short style. To these should be added (if with form found by the author on one tree only but in all the flowers)—flower with curved style. The long style form seems peculiar to the most improved cultivated forms and is most often found on grafted plants where the other two forms have so far been found only on ungrafted plants. The shape of the pistil varies from a more or less regular round to an elongated with central furrow. Those of the first form have a high germinating capacity whereas in those of the second this quality is very weak or nil. These observations help to explain the complicated fertilisation mechanism of the almond flower. Almond trees grafted with biologically similar plants often give low yields and the highest and most constant yields are obtained where the three forms—long style intermediate and short style are united. The intervention of the form with pollen incapable of fertilising its own biological form but capable of fertilising one biologically different (called "triplostauronomic" by DRLEPINO) must here be admitted (Fd).

same plant. The author has frequently observed a slight difference in shape between the glands of spring and autumn leaves. He also found that, between the two common forms described, there are a number of intermediate, often ill-defined forms, which are probably hybrids, in the same way as hybridisation occurs in the case of two forms of gland on one plant and one leaf. The number of glands per leaf and their position on the leaf vary greatly.

The author's observations on 90 varieties of peach make it doubtful whether leaf glands are an indirect protection against insects, as DELPINO assumed. After having defined the two typical forms of peach flower, one with long petals and one with short petals, separated by various intermediate forms (intermediate petals), probably of hybrid origin, the author found a correlation between the shape of the leaf glands and that of the flower. In long-petalled flowers the leaf glands are reniform, in short-petalled flowers they are globular, and in flowers with intermediate petals both reniform and globular glands are present in almost equal proportions. This led the author to the conclusion that the long-petalled peach, the flowers of which are similar in shape to those of the almond, cannot be derived from this plant because of the typical difference in the leaf glands which, in the almond, are always globular.

In the nectarine the author observed the same correspondence between the shape of the flower and that of the glands as in the peach. This observation may be important in deciding whether a variety is pure or not, especially in selection work.

175 Distribution of the Mineral Elements and the Nitrogen in Etiolated Plants. —

ANDRÉ, G., in *Comptes rendus des Sciences de l'Académie des Sciences*, Vol. LXXVII, No. 25, pp. 1004-1006 Paris, December 16, 1918

M. MAQUENNE and DEMOUSSY showed the influence of the presence of calcium on the development of the radicle and the abundance of root hairs during the germination of peas (1). The author studied the proportion of mineral matter and nitrogen which, during etiolation, pass from the cotyledons to the plumule in the case of seeds germinating in complete darkness in an inert medium. Using white beans he found that most of the calcium (about $\frac{2}{3}$) is in the cotyledons, as if it existed in these organs in a form making diffusion difficult. Magnesium passes to the seedlings in a larger proportion than calcium. Of all the bases contained in the seed, potassium is that which passes most completely from the cotyledons. About $\frac{3}{4}$ of the nitrogen and phosphoric acid pass from the cotyledons to the seedling. The distribution of the sulphur is similar to that of the phosphorus. These observations show the development of etiolated seedlings in inert media to take place at the expense of the reserves accumulated in the cotyledons.

(1) See R. August, 1917, No. 717 and R. September, 1917, No. 803 (Fd)

176 - Changes in the Chemical Composition of Grapes During Ripening, in California U. S. A. — BIOLETTI, F. T., CRUESS, W. V. and DAVIS, H., in the *University of California, Publications in Agricultural Science*, Vol. III, No. 6, pp. 103-130 + 18 Figs. Berkeley, 1918.

The experiments described were made during three years, 1914-1916, to determine the changes in the chemical composition during the growth and ripening of grapes of the *Vinifera* varieties cultivated in California. Special attention was paid to the increase in total dry matter and sugar, the decrease in total acids, and the changes in the amount of protein and cream of tartar in the juice of the grapes. The ripening of the leaves was observed and the changes in the starch, sugar, acid and protein contents noted. Many varieties were studied. The methods of analysis used are described; the results, given in a series of tables and diagrams, are discussed fully.

The effect of several factors on the composition of samples taken on the same date was determined by the density and acid content of the juice. It was found that the fruit of young vines ripens more quickly than that of old ones. On the same vine, fruit exposed to the south ripens more quickly than that exposed to the north. As a rule bunches at the base of the stem ripen more rapidly than those at the top, but, in some cases, the opposite occurs. Variations in the Balling degree of 5 lb. samples of the must of bunches similar in appearance and shape, from the same vineyard and picked on the same day, show the difficulty of choosing small groups of grapes of one variety as average samples. Considerable variation was found in the composition of fruit of the same bunch. All these factors should be borne in mind in preparing samples.

The changes, occurring during the development and ripening of grapes, observed throughout the experiments, may be summarised as follows: — The total dry matter remains constant during the period of development, i. e. from the formation till the fruit is almost completely developed but is still green and hard. A rapid decrease in the total dry matter, due to the increase in sugar, then takes place. When the general period of complete ripening is reached, the increase in total dry matter is slow. It may be due to an effective synthesis and secretion of sugar or other solid matter or simply to the evaporation of water. The fact that there is no change in the curve of the decrease in acidity at this period shows that the same process continues and that the increase in the Balling degree represents an effective increase in dry matter. This hypothesis is confirmed by the observations on the increase in dry matter during the ripening of the bunches. The weight of the dry bunches has been proved to show a continuous increase until the maximum (28-75° Balling) is reached.

The total sugar during the period of growth represents a small part only of the total dry matter. During ripening the sugar increases rapidly and later forms a much larger proportion of the total dry matter. During this time the sugar curve follows that of the total dry matter fairly closely. It corresponds more or less to the acid curve multiplied by 5, i. e., it increases as the acidity decreases.

During the first periods of growth of the fruit the acidity increases as a result of the increase in free acids. During ripening the total acids and

free acids decrease rapidly, but when the fruit is ripe this decrease is much slower.

There is a very slow, but usually well-marked increase in cream of tartar during ripening. This increase is much weaker than the decrease in free acids and, consequently, cannot play an important part in this decrease.

The proteins not coagulated by heat increase decidedly during growth and ripening, although this increase is neither as marked nor as regular as the increase in sugar or decrease in total acids.

The difference between the total dry matter and the sugar remains constant to the lowest percentages of the total dry matter; it decreases during the period of rapid growth and remains constant during those of ripening and over-ripening.

177 - **The Pre-determining Influence of the Physiological Conditions of the Seed Upon the Course of Subsequent Growth and Upon the Yield.** - KIDD, F and WEST, C, in *The Annals of Applied Biology*, Vol. V, No. 2, pp. 112-142 + 15 Tables + 2 Figs. + Bibliography of 85 Publications. Cambridge, October, 1916.

As a continuation of their study of this question and as a sequel of their work on the effects of soaking plants in water (1), the authors publish a review of literature on this subject, the examination of which leads to the following conclusions:—

The effect of parental conditions on the subsequent development of the plant may be considerable. The environmental conditions affecting the seed on the parent plant may be divided into two classes:—

1) *The environment of the seed itself*, i. e. its position on the parent plant. This condition affects chiefly the size of the seed and is independent of external conditions. Larger seeds appear to give more vigorous plants and a better yield.

2) *The environment of the parent plant*. Here again differences in size are the only visible effects in the seed itself, but there is evidence that environmental conditions affecting the parents may also have a marked influence on the subsequent course of development of the seed produced. Effects which become visible in one generation may be attributable to external conditions which affected a previous generation.

The question of the pre-determining effect of parental conditions is much complicated by the possibility of hereditary factors being concerned, and the facts have so far usually been considered entirely from a point of view of heredity. These difficulties in the interpretation of results disappear when the later effect on the seed of other conditions, such as harvesting, storage, and germination, are considered. The authors intend to deal with these points in a subsequent paper.

178 - **Difference in the Action of Radium on Green Plants in the Presence and Absence of Light.** - PACKARD, C, in the *Journal of General Physiology*, Vol. 1, No. 1, pp. 37-38, New York, September, 1918.

Experiments made by WILCOCK some years ago on the effect of radium radiations on *Hydra viridis* and *Hydra fusca* showed the green variety

(1) See *R*, Dec., 1918, No. 1341. (*Ed.*)

to be far more resistant to the rays than the brown. The first are not killed by an exposure of $4\frac{1}{2}$ hours to 50 mg. of radium bromide, whereas the second die after comparatively short exposures. The author repeated this experiment, obtaining results similar to those of WILLCOCK. WILLCOCK had also found that protozoa containing chlorophyll are always more resistant than those with none. As the experiments were made in daylight the difference found might be attributable to the activity of the chlorophyll. If this be so plant cells radiated in complete darkness, when chlorophyll is not active, should be much more sensible to the action of rays than cells radiated in daylight.

To solve this question the author made experiments with *Spirogyra* and *Volvox*. Radium (20.4 mg. of element), enclosed in a thin-walled silver tube, was placed on a watch-glass filled with water and the *Spirogyra* filaments laid across it. In the light, the cells nearest the tube began to show a typical disintegration phenomenon in 2 or 3 hours. In the dark the disintegration phenomenon commenced after an average of 45 minutes, i. e. about quarter of the time required in the light. Similar results were obtained for *Volvox*. The author concludes that some condition connected with photosynthesis can prolong the life of the cell, but no definite statement can be made till after further experiments.

179 - **The Temperatures of Small Fruits when Picked.**—STEVENS, N. F. and WILCOX, R. B., in *The Plant World*, Vol. XXI, No. 7, pp. 176-183 + Bibliography of 10 Publications. Tucson, Arizona, July, 1918.

It has been known for more than a century that certain parts of plants may reach a temperature much above that of the atmosphere. Current literature does not, however, seem to contain any reference to the fact, easy to observe, that small fruit on clear days attain a temperature much higher than that of the air; this is probably due to insolation. The authors noticed this for the first time in cranberries (*Vaccinium macrocarpon*) during the autumn of 1916. During the following year they compared the temperature of various small fruit with that of the atmosphere at the time of picking. Besides their botanical interest the data obtained are also of practical interest with respect to the decay of the fruit during transport and on the market.

It was shown that small fruit, especially strawberries, keep better when picked cold rather than warm (i. e. in the afternoon). Already in 1903 Mr. POWELL (*Bureau of Plant Industry, Bull.* No. 40, 1903) observed that peaches picked and packed towards afternoon are warmer and reach the market in less good condition than fruit picked in the morning, though he did not note that, towards midday the temperature of the fruit is above that of the air. The authors collected fruit, put it in a quart basket and placed a thermometer in the fruit mass, near the centre of the basket. The temperature thus observed was that of the outside surface of the fruit and the air circulating amongst it. The temperature was read at intervals of one hour from 6 a. m. to 7 p. m. The greatest difference found between the temperature of the air and that of the fruit was:—strawberries, 9.5°C .

at midday; green gooseberries, 4.5° at 10 a. m.; currants 8.5° at midday; blueberries, 9° at midday; cranberries, 6.5° at 10 a. m.

In another series of investigations with strawberries the external and internal temperatures of the fruit (measured by inserting a thermometer) were compared with that of the air. It has been shown that, in such cases, the rise in temperature may be caused by wounds, but Mr. RICHARDS proved this increase to vary from 0.2 to 1.2° C., negligible figures in comparison with the differences found by the authors. These were, at 10 a. m. and 2 p. m. respectively: — air temperature, 25° and 29° ; temperature of strawberries in boxes, 29.5° and 35° ; internal temperatures of strawberries, in the shade, 29° to 34.5° C., in the sun, 38° – 42° and 39 – 43.5° C., according to the exposure.

The rise in temperature of the fruit is chiefly due to the absorption of radiant energy. As a rule the difference between the temperature of the fruit and that of the air was greatest when the sun was highest, lowest in the morning and afternoon, and practically nil at night and on cloudy days.

18) — Relation Between the Number of Chromosomes and Phylogeny in Different Species of Wheat. — SAZUMURA, T., in *The Botanical Magazine*, Vol. XXXII, No. 379, pp 150–153 Tokyo, July, 1918

In 1913, SCHULZ, who had made a deep study of the origin of cereals, published the phylogenetic table of *Eutriticum* reproduced below:—

	Stock	Groups of cultivated forms		
		with hairy grain	with smooth grain	
			normal	abnormal
One-grained wheat series. . .	<i>Triticum aestivoides</i>	<i>T. monococcum</i>	unselected	unselected
Two-grained spelt series . .	<i>T. dicocoides</i>	<i>T. dicoccum</i>	<i>T. durum</i> <i>T. turgidum</i>	<i>T. polonicum</i> unknown
Ordinary spelt series	unknown	<i>T. Spella</i>	<i>T. compactum</i> <i>T. vulgare</i> <i>T. capitatum</i> (= <i>compactum</i> × <i>vulgare</i>)	unknown

The phylogenetic relations established by SCHULZ have been confirmed by 1) pathology tests with *Puccinia triticea* and *Erysiphe graminis*, made by WAWILOFF in 1913–1915, 2) serum tests made by ZADE in 1914, 3) the principle of fertility and sterility applied by TSCHEKMAK in 1914.

On the assumption that chromosomes transmit to the progeny the characters of the descendants, the author investigated whether determining the number of chromosomes in the species of the genus *Triticum* would throw any light on the phylogeny of cultivated wheats. He, therefore, studied the root-points and parent cells of the pollen in *Triticum vulgare* (winter and spring wheats; varieties Martins Amber, Sapporo, Shirokawayashiro, Red Genealogical, Weisser Kolben), *T. compactum*, *T. Spella*, *T. turgidum*, *T. durum*, *T. polonicum*, *T. dicoccum*, *T. monococcum*.

In these wheats he found the following numbers of diploid chromosomes: *T. vulgare*, 42; *T. compactum*, 42; *T. Spelta*, 42; *T. turgidum*, 28; *T. durum*, 28; *T. polonicum*, 28; *T. dicoccum*, 28; *T. monococcum*, 14.

These figures show that the number of chromosomes tends to increase in the different species of *Triticum* with their degree of evolution and cultivation; it is lowest in *T. monococcum*, the most primitive species, and highest in *T. vulgare*, the most developed and selected species.

The number of chromosomes found by the author confirm the phylogenetic data of SCHULZ mentioned above, as they are graded as follows in the different species of cultivated wheat:—

One grained wheat (<i>T. monococcum</i>) . . .	14 chromosomes phylogenetically diploid
Two grained spelt (<i>T. dicoccum</i>) . . .	28 " " tetraploid
Ordinary spelt (<i>T. Spelta</i>)	42 " " hexaploid

These results allow the author to confirm cytologically SCHULZ's phylogenetic table, the correctness of which had already been shown by WAWILOFF, ZADE and TSCHERMAK, though by other methods. It may be assumed that the unknown stock of *Triticum vulgare* had 7 haploid and 14 diploid chromosomes, as is the case for rye (*Secale cereale*). The determination of the number of chromosomes of *Triticum dicoccoides* would be of great value as it would help to determine the stock of cultivated wheat. The sterility of hybrids of certain species of wheat is partly due to the fact that during meiosis in species with an abnormal number of chromosomes these chromosomes often divide irregularly with formation of sterile pollen grains.

181. — **The Work of the Genetic Station of Verrières, France, since 1902.** — MENDEL, A., in the *Bulletin de la Société Nationale d'Acclimatation*, Year LXX, No. 2, pp. 43-55 + 3 Figs., No. 3, pp. 81-90 + 2 Figs., No. 4, pp. 115-121 + 1 Fig., No. 5, pp. 134-136 + Bibliography of 35 Publications. Paris, 1918.

The genetic experiments at Verrières date back to the foundation of the station in 1815, but it was only in 1902 that new and important experiments were undertaken by M. P. DE VILMORIN with the object of verifying MENDEL's law and determining its application to new cases. The Verrières experiments were started with peas, the plant used by MENDEL, but extended to many characters MENDEL had not studied. They were then extended to potatoes, beets, beans, cereals and several other plants. The author summarises the different characters studied and the problems raised during the course of the experiments from 1902 onward.

PEAS. — Characters studied:—

- 1) Shape of seed.
- 2) Colour of cotyledons.
- 3) Colour of seed-coat.
- 4) Shape, size and structure of ripe pods.
- 5) Colour of unripe pods.
- 6) Arrangement of flowers.
- 7) Length and development of stem.
- 8) Colour of flowers and leaves.
- 9) Adherence of seeds to each other.

10) "*Acacia*" foliage. — Under the name of "acacia" is cultivated a variety of pea of the Verrières collection which is very curious as it is completely devoid of tendrils as a result of the absence of a factor which, in normal plants, inhibits the development of leaflets after the first pairs and replaces them by tendrils. This absence of tendrils, which is a disadvantage, as the plants cannot support themselves without props, may in some cases be useful. In Holland, for example, where the pea is extensively grown for the production of seed to be eaten dry, large varieties giving a high yield are used. The plants are grown in lines and not propped. During hoeing the plants are thrown alternately from one side to the other, an impossible procedure when the plants are sufficiently developed to cling together by their tendrils. In exceptionally wet years the plants may be smothered by weeds and the crop seriously compromised. To obviate this disadvantage a strain without tendrils but having all the other qualities of the Dutch peas was created at Verrières. The absence of tendrils has also been combined with the fasciation of the Turkish pea. A fixed, semi-dwarf, fasciated variety without tendrils and with abundant foliage which does not cling has been obtained. This variety should be of value in Sweden, where the pea is cultivated as fodder.

11) *Number of flowers per peduncle.*

12) *Colour of hilum.* — The hilum of the seed in most varieties of peas is colourless, or paler than the rest and in a few strains only is there a very distinct black mark showing exactly the point of attachment of the ovary. This character "black hilum", much studied at Verrières and by TSCHERMAK, is dominant to the character "colourless hilum". Certain curious cases occur which have never been satisfactorily explained. On one hand plants sometimes occur with mixed hilums, i. e. seed with black and white hilums in the same pod, and, on the other, there is a close relation between the violet colour of the seed coat and the presence of the black hilum. It seems that the plant bearing violet seed springs from seed with a black hilum.

WHEAT. Characters studied: —

1) *Compactness of ear.* — This character has been studied particularly by SPILLMANN and by BIFFIN. The character "loose ears" is dominant to the character "compact ears", but in some cases the ear in the F_1 is of intermediate compactness.

The difference is very marked in the Verrières crosses, Touzelle anone wheat \times Massy, which, in F_1 gives a loose ear, and Touzelle anone \times Hérissou sans barbes, which gives an intermediate F_1 .

2) *Presence or absence of awns.*

3) *Hairiness of glumes.*

4) *Colour of ear.*

5) *Ramifications of ear.* — A typical cross from a point of view of the re-combination of characters is that made at Verrières in 1911 between Blé de miracle (*Triticum turgidum*, variety with much-ramified ear) and Polish wheat (*T. polonicum*, distinguished by its long, leaf-shaped glumes). The F_1 plant was quite normal in its non-ramified ear and normal sized

glumes. In F_2 , however, there was a great variation, with the reappearance in a strictly Mendelian ratio of plants with the ears of Miracle and those with the long glume of Polish wheat. The characters were also combined and very curious plants with very ramified ears and long, leaf-shaped glumes were easily fixed.

- 6) *Height.*
- 7) *Supernumerary spikelets.*
- 8) *Resistance to rust.*
- 9) *Colour of seed.*
- 10) *Periodicity.*
- 11) *Presence of bracts at the base of the ear.*
- 12) *Fragility of axis.*

By selection and suitable crosses new and good varieties of wheat have been obtained, including (in addition to the well-known Hybride Inversable de Vilmorin and Blé des Alliés):— 1) a hairy and bearded wheat, resistant to scorching, created especially for the Balkans; 2) a series of hard beardless wheats; 3) a wheat for South Algeria, obtained as a result of crosses made to study earliness between a very small wheat with very hairy glumes, received from the extreme south of Algeria, and the ordinary, high-yielding French varieties; 4) for Argentina, where the variety most cultivated and best suited to the climate is Barletta wheat; crosses have been made between this variety and the best French wheats. All the F_1 was sent to Dr. BACKHOUSE, genetist to the Argentine Government, at Buenos Aires; 5) with the same object in view Chili wheat, which can stand a long time when fully ripe (a very valuable quality in that country) has been crossed with some of the best French wheats. Plants which tillered abundantly were obtained in the second generation; one, without special attention other than ordinary transplanting, gave, at a height of 49 inches, 53 culms and more than 1700 grains.

OATS. — Characters studied:—

- 1) *Colour of seed coat.*
- 2) *Shape of panicle.*
- 3) *Adherence of coat to grain.*
- 4) *Earliness.*

BARLEY. — Characters studied:—

- 1) *Number of rows of grain per ear.*
- 2) *Colour of grain.*
- 3) *Adherence of coat to grain.*
- 4) *Smooth awns.*

— A smooth-awned form was found at Verrières, in black six-rowed barley, whereas, in the other varieties, the awns are rough, owing to the presence of very fine teeth. This peculiarity, which might prove valuable in countries where barley is used as green fodder (the very rough awns of the ordinary varieties wound the animals), was studied at Verrières. It arises from the absence of a single genetic factor, as is shown by the results of crosses with varieties with ordinary awns. The F_1 plants all have dented awns, and one quarter of the F_2 plants have smooth awns.

BEEF. — The investigations made in the chemical laboratory at Ver-

rières on the enzymes of the sugar beet show that there is only one factor whose presence destroys the sugar.

Characters studied:—

1) *Colour of root*. — The white (absence of colour) is recessive to the coloured forms.

2) *Dehiscence of glomerules*, studied on a variety with dehiscent glomerules.

3) *Production of seed the first year (annual plants)*. — This character is recessive to the normal one.

CABBAGES, TURNIPS, BEANS, ONIONS AND POTATOES were all subjected to numerous investigations of practical and scientific value. Several factors are concerned in the colouring of the onion; in many cases *yellow*, is dominant to *red* and *white*, but a recessive *yellow* is also found.

ORNAMENTAL AND MEDICINAL PLANTS. — The cross *Argemone mexicana* (with yellow flowers) \times *A. platyceras* (with white flowers) is an excellent example of marked and unexpected variations in F_2 as a result of numerous latent factors. Whereas the F_1 plants show characters intermediate to those of the parent with pale yellow flowers, the F_2 plants include a number of completely new forms as regards colour (shammy-leather colour), the form of the flower (double), foliage, habit of growth, etc.

The cross *Saponaria ocymoides* (with small, white, sterile flowers) \times *S. ocymoides splendens* (with large, pink flowers) gave in F_1 , plants resembling the *splendens* form, and, in F_2 , out of 8 plants, 5 with pink flowers, 1 with white flowers, and 2 with white flowers which turned pink when open. The last, new form has been fixed and is called *S. ocymoides versicolor*. A form with large, white, fertile flowers has also been fixed.

Other ornamental plants studied were *Digitalis*, *Gladiolus*, *Nicotiana*, *Petunia*, *Primula* and *Thladiantha*.

TREES. — *Abies Vilmorini* is a fine hybrid between *A. Pinsapo* and *A. cephalonica*, obtained artificially at Verrières by H. DE VILMORIN in 1867. A study of the F_2 showed marked dissociation of the leaves, certain plants returning to the *A. Pinsapo* type.

182 - The Selection of Cereals at the "R. Stazione Sperimentale di Granicoltura" of Rieti, Italy. — STRAMPPELLI, N., in I. *Bollettino degli Agricoltori Italiani*, Vol. XXIII, Nos. 10-11, pp. 417-421. Rome, 1918. — II. R. Stazione Sperimentale di Granicoltura in Rieti, *Il Frumento "Carlotta Strampelli"* nell'anno agrario 1916-1917, *Relazione a S. E. il Ministro per l'Agricoltura*, 110 pp. Terni, 1918.

During these last two years the "R. Stazione Sperimentale di Granicoltura" of Rieti (1) has produced, by hybridisation and selection, valuable new varieties of cereals. Other varieties which were still being studied in 1916 have given good results in numerous cultural tests and are becoming more and more popular with growers.

Wheat. — The hybrid Rieti \times Massy No. 367, called "Carlotta Strampelli", is distinguished by its resistance to rust and lodging, its adaptability

(1) The preceding work of the Cereal Experiment Station of Rieti is summarised in a paper by Dr. G. PATANÉ, *The Selection of Cereals in Italy*, R., June, 1916, pp. 777-781. (Ed.)

to the soil and climatic conditions of northern and central Italy, and, above all, by its great productivity. In the Rieti experiment field it has yielded constantly during eight years more than 32.6 cwt. of grain per acre. During the four years it has been grown by several farmers and agricultural institutions it has everywhere given results confirming its superiority over all other Italian and foreign varieties of wheat. In 1917, it gave the following averages of grain (cwt. per acre) in excess of the varieties with which it was compared: — Piedmont, 7.07; Lombardy, 5.28; Venetia, 3.23; Tuscany, 3.58; Emilia, 4.36; the Marches, 2.94; Umbria, 6.00; Abruzzi-Molise, 0.98.

Although the Carlotta Strampelli variety was created to supply a productive wheat in the plains and hills of central and northern Italy, it also gives good results in southern Italy so long as it is grown in very fertile and cool districts; this was proved by the cultural experiments made in the provinces of Caserta and Avellino, as well as in the upper Agri valley. Basilicata. In this last district Carlotta Strampelli wheat yielded 11.4 cwt of grain per acre, exceeding all the other varieties — Original Rieti, 8.7; Serpentina (*Triticum turgidum*), 7.5; Zingarella (*Triticum durum*), 6.7; Vilmorin hybrid, 8.7; Bianco (*Triticum turgidum*), 7.4; Bianco peloso, 5.1; Panella 5.8, Hard spring wheats, 4.3.

The material obtained in the attempts to create types of productive wheat resistant to drought has already given good results. In 1918 the soft beardless wheat Gargano gave 21.5 cwt of grain per acre, the soft bearded wheat Apulia 17.5, as compared with only 11.9 cwt. produced by the soft native wheat of Apulia, Bianchetta pugliese. The hard wheat Dauno nuovo, however, produced 18.3 cwt. of grain per acre as compared with 14.3 for the native hard wheat Duro di Puglia.

MAIZE — Various crosses made to obtain early, very productive varieties, with limited vegetative development, gave 341 new types. Among the most valuable of these as yet subjected to multiplication and district tests in the various localities of central and northern Italy, may be mentioned; — Luigia Strampelli, Alfredo Strampelli, Saverio Strampelli, Principe Potenziani, Elena, Guido Baccelli, Ideale, Eureka, Pioniere.

These types show a marked reduction in culm development, especially Guido Baccelli, the thin stem of which is out of all proportion to the very large ear. They all ripen early. The earliest is Pioniere; in the plain of Rieti, sown after mid-May, it is already ripe about August 20, i. e. after 90 to 100 days, whereas the local maize sown in May ripens only in October. The latest (ripening at the end of September) is Principe Potenziani, but it is also the most productive; it has grain very rich in gluten and oil which ripens while the rest of the plant is still green and may be used as fresh fodder. The types most resistant to drought are Alfredo Strampelli and Saverio Strampelli, especially the latter, which nearly always survives the aridness of the Foggia district, Apulia. All these new maizes give a high grain yield, sometimes exceeding 55.7 cwt. per acre.

183 — "**Blé de cent jours**" Obtained by Hybridisation and Selection at Nages, France.

— VITTORELLI, G., in the *Revue internat. de Génétique*, Year V, No. 7, pp. 195-102 Nages, Tarn, 1918.

This paper gives the results of wheat selection work at the "Institut central de Génétique" at Nages, Department of the Tarn, France. The following characters were studied: — 1) earliness; 2) resistance to disease both parasitic and non parasitic; 3) resistance to frost.

1) EARLINESS. — The fine season at Nages lasts, on an average, 100 days, from May 10 to August 10, so that, to obtain a good harvest and perfect ripeness the vegetative period must be as short as possible. It is necessary to produce a wheat ripening in 100 days. All the commercial spring wheats tested at Nages from 1907 onwards required 150 to 165 days to ripen, so that the vegetative period had to be reduced by at least 50 days, or $\frac{1}{3}$ of the total. The results so far obtained make it possible to foretell with certainty complete success in the near future. Starting with 150 days, it was reduced first to 140, then, two years ago, to 120, and now it is 115 days. Very soon it will be reduced to 110, thanks to a variety called "Cent jours de Laponie". These 100 days correspond to the vegetative period required at Lyngen, near Cape Nord, where wheat must ripen within three months.

2) RESISTANCE TO DISEASE. — In the valleys of Nages the great humidity during June and July causes serious and wide-spread attacks of rust every year. In the hybridisation and selection work varieties very resistant to *Puccinia* were used and now, after 10 years, all the "Blés de cent jours" are absolutely immune to rust, even in a year such as 1917. The immunity of these wheats is due, not only to their earliness which helps them to pass the critical period with rapidity, but also to the structure of the leaves which gives no hold to the mycelium of the parasite for vegetation or feeding. The wheats obtained also appear very resistant to bunt, smut, and lodging.

3) RESISTANCE TO COLD. — Spring wheats which grow from May to September naturally avoid the winter cold. To satisfy the requirements of high, mountainous districts, attempts were made to obtain a spring wheat which could also be grown as a winter wheat:—

a) as *spring wheat*, sowing during the second half of May and harvest during the first half of September;

b) as *winter wheat*, sowing at the end of August, flowering at the end of the following May, and harvest during the first 10 days of July.

Seed may, therefore, be sown from August till the end of the following May; this is a great advantage in the distribution of work. Moreover, if the wheat is harvested at the beginning of July another crop may be grown on the same soil during the rest of the fine season. To do this, however, the wheat must be able to bear a winter cold of from -20° to -25°C . To increase the resistance of the new varieties, Himalayan wheat and many varieties from Saskatchewan and Alberta, Canada, growing in the 53rd degree of north latitude, were used.

POSSIBLE DISTRIBUTION OF THE NEW WHEATS. — "Blés de cent jours" do well from the saline springs of Camargue, where they ripen in about 85

days, to the slopes of the Alps, where they will grow at altitudes of 5 140 ft., and even 5 570 ft. in the mountains of Savoy. Natives of a granite district, where the soil is always light and aerated, they do not like the compactness of either calcareous or clay soils in which the root, accustomed to air, suffocates. There are very few such soils in France, where they form barely 2 % of the arable land.

184 - Origin and Qualities of "Red Rock", a New Variety of Autumn Wheat, in Michigan, U. S. A. — SPRAGG, F. A., in the *Thirtieth Annual Report of the Agricultural Experiment Station, Michigan* pp. 661-675 + 5 Figs. Lansing, 1917.

Red Rock wheat is derived from a *red* seed obtained from an ear of Plymouth Rock (*white*), sown in the autumn of 1908 and inscribed under the number 970 003.

Characteristics — Resistance to cold, very strong straw, excellent for bread-making. With respect to productivity, making the yield of Red Rock wheat equal to 100, the following figures were obtained during the test period 1912-1915 — American Banner, 74.3; Buda Pesth, 68.3; Shepherd's Perfection, 58.8; Plymouth Rock (original), 73.4; Early Windsor, 76.9; Mealy, 57.8; European Century, 87.1; Craig's Favorite, 86.9; Stoner Miracle, 73.4; Berkley, 79.1; Rock, 67.3; Babcock, 87.7; Early Ripe, 72.7.

Red Rock is, therefore, much superior to all the varieties examined. In 1917, more than 4 940 acres were sown to this wheat in Michigan State.

185 - New Varieties of Wheat and Oats Selected at Svalöf, Sweden. — NILSSON, H. N., in the *Svenskes UtsädeförmånsTidskrift* Year XXVIII, Pt. 1 pp. 116-119. Malmö 1918.

Svea wheat (191, "Svealvete '0826). — A new variety obtained at Ultuna from the cross Pudel × Samuets. Its characteristics are — great resistance to cold (like the parent Samuets), strong straw, resistance to rust, high yield. This new variety is destined to replace the native wheats in the most northern districts of the wheat belt, where it is impossible to grow Thule II successfully.

Björn oats II (197, "Björnhafre" II, 01120 b), obtained by pure line selection from the Björn variety which it exceeds in yield and percentage of grain.

Oat 199, 01163, obtained from the cross Guldregn × Dala. This new variety ripens about the same time as Dala, the earlier parent, which it surpasses in yield, strength of straw, and quality of grain. This oat could be successfully grown in many districts of central and northern Sweden for which the Guldregn and Lågowa varieties are too late.

186 - Greenhouse Experiments on the Rust Resistance of Oat Varieties, in the United States. — PARKER, J. H., in the *U. S. Department of Agriculture, Bureau of Plant Industry Bulletin* No. 629, 16 pp., + 2 Figs + 3 Plates. Washington February 1918.

In the United States extensive damage to oats is caused almost every year by two kinds of rust, stem rust (*Puccinia graminis* f. *Avenae* Erikss. and Henn.), and crown or leaf rust (*Puccinia Lolii*, f. *Avenae* McAlpine). The paper under review describes a series of inoculation experiments made on numerous varieties of oats in a hot, damp greenhouse (conditions favourable to the development of rust) in order to obtain material for use in hy-

bridisation and selection work aiming at producing resistant types. These methods were adopted because simple observations made under natural environmental conditions do not give an exact criterion of the degree of immunity of a variety. For example, Sixty Day and Kherson, recommended as resistant, proved during the experiments to be very susceptible; their apparent resistance is only due to their earliness, which enables them to ripen completely before the occurrence of conditions favourable to the development of rust. The use of these two varieties as hybridisation material might, therefore, give unsatisfactory results.

In all 3 256 inoculations were made at two different periods of growth a) the seedling stage; b) the earing stage. Only two varieties proved completely resistant to stem rust — White Tartarian and Ruakura Rustproof. Several varieties of the red-oat group (*Avena sterilis*), including certain strains of Burt, Cook, Appler, Italian Rustproof, Red Rustproof, and Turkish Rustproof, proved very resistant to crown rust. Only Ruakura Rustproof proved resistant to both kinds of rust. Several varieties resistant to crown rust are very susceptible to stem rust. Resistance to rust, is therefore, a specific character, which can be modified by hybridisation and selection.

CONCLUSIONS. — The results obtained during the investigations described offer a basis for the choice of material in selection work.

187 **Stability of Hybrids of Pima × Gila Cotton, in Arizona, U. S. A.** — KEARNEY, T. H. and WELLS, W. G., in *The American Naturalist*, Vol. LII, Nos. 622-623, pp. 101-106, June 1918. (October-November 1918)

Most of the previous hybridisation studies of cotton have been made with different varieties such as Sea Island (*Gossypium barbadense*) and Upland (*G. hirsutum*), and Egyptian (1) × Upland. The resulting hybrids are very variable in the F_2 and following generations, and it has been impossible to fix them in spite of careful selection work carried out over 6 or 7 generations. Little is known, however, of the behaviour of hybrids of varieties of a same species. It is not known whether they are less variable than hybrids between different species, thus making it possible to fix new and valuable combinations of characters. The investigations described, made in the Co-operative Testing Garden at Sacaton, Arizona, form a good contribution to the solution of this problem.

METHOD. — Two varieties were used, Pima and Gila, derived by mutation from Mit Afifi, from which the first differs more than the second. Three generations of parents — P_1, P_2, P_3 — and three generations of hybrids — F_1, F_2, F_3 — were observed. Crosses were made between these hybrids and each of their parents. Thus, in 1915, some of the flowers of the F_1 plants were fertilised with the pollen of Pima and others with the pollen of Gila, giving hybrids $3/4$ Pima and $3/4$ Gila. In 1916 these hybrids were, in their turn, fertilised with pollen from the parents, and produced hybrids $7/8$ Pima and $7/8$ Gila.

(1) Egyptian cotton does not form a botanical species properly speaking, but is distinguished from Upland cotton by such characters that their hybrids behave as if obtained from a cross between two distinct species (Author)

CHARACTERS STUDIED — Pima and Gila differ in 24 characters, only 6 of which are independent, all the others being connected by physiological correlation. Most of the characters are concerned with the shape or size of certain organs (e. g. length of internodes, leaves, floral parts, fibre, etc.). The *leaf-index* $\left(\frac{\text{length}}{\text{width}} \times 100\right)$ and *boll index* $\left(\frac{\text{length}}{\text{diameter}} \times 100\right)$ vary greatly in the two varieties. Three characters which could not be measured exactly were determined by grading; they are colour of fibre, amount of fuzz on seeds, and roughness of the boll surface (which increases with the greater number and depth of the pits in which the oil glands are situated).

CHARACTERS OF THE HYBRIDS. -- 1) *Average values.* — In the simple hybrids, Pima \times Gila, the characters were intermediate to those of the parents.

2) *Coefficients of variation* — The most important fact observed was the stability of the hybrids. The average variability of the F_2 plants did not exceed that of the most variable parent, Gila, and two F_2 descendants had the same low variability as the least variable parent, Pima. These facts point to the possibility of obtaining relatively uniform new varieties of cotton by crossing varieties of one species.

DISTRIBUTION OF CHARACTERS. -- The relative stability in the hybrids of three very important characters, length of fibre, leaf index, and boll index, was confirmed. In the F_2 , the difference between the maximum and minimum values was always less than for the parents. In the crosses Egyptian \times Kekchi (described by COOK) and Egyptian \times Hindi (described by MARSHALL), however, the maximum and minimum values of the hybrids sometimes greatly exceeded those of the parents.

In the cross Pima \times Gila the roughness of the boll, colour of the fibre and amount of fuzz on the seeds, all included by BALS and McLENDON in the list of allelomorphous characters in cotton, behaved like size and shape characters, showing no scission and re-combination in the Mendelian sense.

OTHER OBSERVATIONS. — The behaviour of the hybrids $\frac{3}{8}$ Pima or Gila and $\frac{7}{8}$ Pima or Gila is interesting. The biometrical values swayed rapidly towards the preponderant parent, and in the $\frac{7}{8}$ hybrids the influence of the other parent practically disappeared; this is shown by the following figures:

	Leaf index	Boll index
Pima	78.1 \pm 0.11	173 \pm 0.18
Pima $\frac{7}{8}$ = [(Pima \times Gila) \times Pima] \times Pima	78.7 \pm 0.63	179 \pm 0.66
Gila $\frac{7}{8}$ = [(Pima \times Gila) \times Gila] \times Gila	94.1 \pm 0.47	153 \pm 0.90
Gila	93.1 \pm 0.47	156 \pm 0.51

No mutation was observed throughout the investigations.

CONCLUSIONS. — The characters of the hybrids Pima \times Gila are inter-

mediate to those of the two parents. Certain characters which behave as allelomorphs in other crosses did not, in this case, give rise to any obvious segregation or re-combination. The F_2 and following generations are very stable. There is no genetic correlation between the characters. No dominance or recessiveness was observed in the characters. It should be possible, by crossing varieties of one species, to obtain new and useful combinations of characters.

188 — Selection of Sugar Cane Resistant to Frost, in the Gurdaspur District, India,
S.c No 153 of this *Review*

189 — Hybridisation of Eggplants, in the Philippines. — BAYLA, A S, in *The Philippine Agriculturist*, Vol VII, No. 3, pp 66-71 Los Baños, October, 1918

In the Philippines preference is given to native varieties of eggplants on account of their flavour and the greater firmness of their flesh which makes them more satisfactory for cooking purposes than the foreign varieties. Native varieties are, however, inferior to foreign ones in size, yield and uniformity of colour which ranges from dark purple to whitish green. The results are given of a series of crosses between the Native Long variety and New York Improved variety, characterised by its globular shape and the uniform purple colour of its fruit.

F_1 HYBRIDS. — They differed from each of their parents by: — 1) more vigorous growth (the average diameter of the stem above the ground is 17 mm. as against 15 mm.; 2) high resistance to bacterial disease (*Bacillus Solanacearum* Erw. F. Smith), 3) large production of fruit containing few seeds, 4) the intermediate, pear shape and intermediate colour of the fruit.

F_2 HYBRIDS. They differ from the F_1 hybrids by: — 1) greater size and weight of their fruit, 2) total disappearance of the resistance to bacterial disease which appeared in F_1 , 3) colour of the fruit which in the F_2 of the New York Improved \times Native Long cross, is a fine purple, resembling the colour of the New York Improved variety instead of green, as in the F_1 .

It seems, therefore, possible to improve the native Philippine eggplants by hybridisation and selection, thus increasing both the yield and size of the fruit.

190 — Marquis (1) and Huron Wheats in Canada. — MOF G G, in *Dominion Experimental Farms, Seasonal Hints, East and British Columbia*, No 10, pp 56, Ottawa, March, 1918

Marquis wheat has done so well in the prairie provinces that it has put the other good varieties introduced by the Experimental Farms into the shade. Canadian farmers have tested this wheat all over the country, but, as a rule, it has proved more suitable to the prairie provinces than any others.

Huron wheat was intended for the other parts of Canada. It was thought it would prove more valuable in the east than Marquis in the

(1) See *R* June, 1918, No. 611. (*Ed.*)

great western plains. As, however, it is not primarily an export wheat, preference has usually been given to Marquis.

Both these wheats have red grain. Huron is bearded and has red glumes, whereas Marquis is beardless with yellow glumes. The first threshes easily as it has not the close glumes which suits the second so well to districts visited by strong winds during the ripening period. Both have strong straw and ripen about the same time. On account of their high gluten content and bread-making value Canadian wheats are much sought after by English millers, who mix them with soft English wheats deficient in these qualities.

Marquis, which is unequalled for hardness of grain and bread-making value, is an ideal export wheat. The bread-making value of Huron enables good quality bread to be made of it, but it is not so valuable as Marquis for the export trade. It should, therefore, not be grown in the western districts with a high reputation, but may be recommended to farmers in the east and British Colombia as probably the most vigorous, most productive and most satisfactory generally for most of the soil and climate conditions. In Manitoba, Saskatchewan, and many parts of Alberta, however, preference should be given to Marquis which is singularly well suited to the requirements of these districts.

191 **Comparative Cultural Tests with Different Varieties of Wheat and Rye, in Sweden.** — LJUNG, E. W., in *SKRIFTS Utgåklörens s Tidsskrift*, Ye 1 XXVIII, Pt 4, pp 161-169. Ma mo, 1918

The results are given of comparative cultural tests made in different localities of southern and central Sweden to determine those in which rye should be preferred to wheat and vice versa.

SVALÖF. — *Varieties of wheat tested* : — Pansar, Sol, Bore, Extra Square-head II, Native Swedish ("Svenskt landthvete") *Varieties of rye tested* : — Stiärn, Petkuser, Bretagner, Grey Oestergötland Rye ("Ostgota Grårag").

During the period 1907-1917 winter wheat produced slightly more than rye. Thus, Pansar gave an average of 44.7 cwt. of grain per acre, or 5.0 cwt. more than Stiärn, the best rye. Native Swedish Wheat produced 31.1 cwt. of grain per acre, or 1.9 cwt. more than Grey Oestergötland rye. On the other hand the oldest varieties of wheat, such as Sol, Bore, and Extra Squarehead II, gave about the same yield in grain as Stiärn rye, i. e. in cwt. per acre respectively : — 35.8, 35.5, 38.3, 36.7. Stiärn rye (36.7 cwt.), Petkuser (31.2 cwt.) and Bretagner (35.6 cwt.) wheats gave a higher grain yield than Native Swedish Wheat (31.1 cwt.). These results show that the choice of the cereal best suited to a given locality depends less on the *species* than the *variety*, which, in its turn, depends largely on selection, by which it can be largely modified.

ALNARP. — The difference between Pansar wheat and Stiärn rye is still more marked at Alnarp than Svalöf. This is shown by the yields in grain per acre of these cereals respectively : — 54.6 cwt. and 24.5 cwt. Stiärn rye also proved inferior even to Guldkorn barley which yielded 31.7 cwt. of grain per acre. These unfavourable results may be attributed to the nature of the soil which is mostly compact, cold, and ill-suited to rye.

BJERKA SÄBY (Oestergötland School of Agriculture, 2° of latitude further north than Svalöf). — *Varieties of wheat tested* : — Bore and Sol. *Varieties of rye tested* : — Selected Wasa and Petkuser. The average yields in grain for the period 1907-1917 (Bore 23.5 cwt., Sol 23.0 cwt., Wasa 18.6 cwt., and Petkuser 17.8 cwt.) show wheat to retain its superiority over rye.

ULTUNA. — Considering the northern latitude of this locality (60°, or 4° further north than Svalöf) and in spite of the favourable soil conditions, wheat here loses its superiority over rye, producing the same quantity of, or often even less grain than, rye. The weather conditions are clearly more favourable to rye.

192 - **Comparative Cultural Tests with Barley, Spring Wheat and Oats in Different Parts of Sweden.** — LJUNG, E. W., in the *Sveriges Utsädesförenings Fälskrift*, Year XXVIII, Pt. 4, pp. 169-172. Malmö, 1918.

The results are given of a series of comparative cultural tests with different varieties of spring wheat, barley and oats, made to determine which of these cereals are best suited to given districts.

SVALÖF. — Varieties studied : — Vårparl and Kolben Wheats, Gullkorn and Prinsess barley, Seger and Guldregn oats. During the experimental period 1900-1917, barley gave the best results, proving much superior to oats and still more so to spring wheats. The yields obtained, in cwt. per acre, were : — Gullkorn 25.0, Prinsess 24.2, Seger 21.6, Guldregn 21.8, Vårparl 20.5, and Kolben 19.9.

ÅLNÄR. — The superiority of barley over the other two cereals was yet more marked. Its grain yield exceeded that of oats by 7.2 to 7.9 cwt., that of spring wheat by an average of 6.4 cwt. Wheat seemed equal, or even superior to oats as a result of the particularly favourable soil and cultural conditions.

BJERKA-SÄBY AND ULTUNA. — Barley remained the best and spring wheat came last. The grain without glumes has been taken into account in calculating the yields of both barley and oats.

193 - **Cereals and Leguminosae of French West Africa.** — See No. 146 of this *Review*.

194 - **Potatoes of the Canary Islands.** — BOIS, D., in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXXV, No. 12, pp. 569-570. Paris, December, 1918.

Potatoes have long been grown in the Canary Islands to supply England with early ones. To assure production seed potatoes are sent from England each year in October or November to the Canary Islands because, in a subtropical climate, the European varieties must be renewed if a remunerative yield is to be obtained, as disease and degeneracy rapidly make the tubers unfit for reproduction. Tubers received from England are cultivated in winter, from October to May. There are, however, in the Canaries, local varieties which have been grown by the peasants for years, and are perfectly adapted to the climate. These potatoes give a much higher yield than do the European varieties and are preferred by the natives because, instead of being floury, they have firm, consistent flesh.

At the request of the author, vice-president of the "Société nationale d'Acclimatation de France", the French Consul at Teneriffe sent the Society tubers of the Papas blancas, Papas negras, Papas palmeras, Colorados de Baga, and Meloneras varieties. Some of these were sent to the Paris museum and to the firm of VII MORIN-ANDRIEUX & CO. to be compared with other known varieties. Others have been sent to Algeria, Tunis and Tangiers for cultural tests in these countries.

195 - Roots and Tubers of French West Africa. — See No 146 of this Review

196 - Cultivating and Ensilaging Goat's Rue to Free it from its Bitter Element and Make it Usable as Fodder; Experiments in Italy. — See No 168 of this Review.

197 - Relation between the Length of Cotton Fibre and Rainfall, in the Lesser Antilles — KIRSICK, R. R., in the *West Indian Bulletin*, Vol XVII, No 2, pp 79-82 + 1 Diagram Barbados, 1918

In Egypt, after irrigation, cotton fibre grows long in a very few days. At the I.A. Guerite Experiment Station, St. Kitts (Lesser Antilles), the author noticed that in 1917-1918, a very dry year (during August, when 60 % of the flowers open, there were only 76 mm. of rain), the fibre in selected Sea Island plants was shorter than in the previous year when, during the flowering month, 279 mm. of rain fell. He also observed that the staple of bolls which open late (the second half of October) is some millimetres longer than that of bolls which open earlier (beginning of September). In 1917, for example, the staple of bolls bursting on September 13 was 49 mm. long, that of bolls bursting on October 18, 57 mm. long. This was because the bolls which opened latest were from flowers which had had benefited by 177 mm. of rain during their critical period (from the 15th to the 21st day after flowering), whereas the bolls which burst first came from flowers which had had only 64 mm. of rain during their critical period. Curves of the rainfall during the first 24 days of the boll's growth and the length of the staple at the time of dehiscence proved very similar. This seems to show that, in the Lesser Antilles, the length of the fibre depends on the amount of water the plant receives during the critical period of the growth of the bolls.

198 - Possibilities of Cotton Cultivation in the South Pacific Islands. — *The Board of Trade Journal*, Vol CI, No 1184, p 260. London, 1918

With suitable labour and a fair market, the South Pacific Islands, according to the Report of the Inter-State Commission of Australia on the trade of the South Pacific, offer a wide and promising field for cotton cultivation. In New Caledonia and the New Hebrides the French have shown how promising is this field both from the point of view of production and consumption.

NEW CALEDONIA. — A recent Consular Report states that it was only a few years ago that cotton growing was started in New Caledonia, but it is already a flourishing industry, and promises to assume important dimensions. It first appears in the list of exports in 1908, with a total of a lit-

tle over half a ton. Since then progress has been rapid, as the following figures show:—

1908	11 cwt.	worth. £	44
1909	3 tons	"	£ 275
1910	12		£ 858
1911	41	"	£ 3 633
1912	197	"	£15 536

The value of cotton exported in 1914 was £7300, as against £10,000 in 1913. Owing to the fall in price of cotton due to the war, planters held their stocks. A considerable quantity of cotton seed has also been exported from New Caledonia.

Commenting on the quality the authority states that the plant grows well, even in the poorest soil; and in good soil, where proper care is taken, yields abundantly, the average in such cases being between 1 200 and 1 500 kg. (2 582 and 3 254 lb.) of seed cotton per hectare (2.47 acres). In the most favourable spots and under careful cultivation the yield is said to be considerably higher.

The quality also is excellent. In 1912 the cotton was quoted on the Havre market at from 1s. 1d. to 2s. per kg. A small consignment was recently sent from Noumea to Liverpool, and is reported to have been sold at a higher price than the maximum paid at Havre. The price paid to local planters is 4.8d. per kg. (unginned). The present area under cotton is estimated to be from 800 to 1 000 hectares (1 976 to 2 470 acres).

An interesting feature of cotton cultivation in New Caledonia is that it is not annual as in America and Egypt, but perennial, the cotton plant, in consequence of the absence of frosts, thriving and producing for many years. The growing of cotton in New Caledonia has been encouraged by the establishment at Noumea of a cotton-ginning plant. The variety of cotton cultivated is the *Gossypium peruvianum*.

NEW HEBRIDES. In an article on the New Hebrides, which appeared in the *L'Océanie Française*, it is stated that the French colonists have only tried cotton-growing during the last 3 years. They entered into this venture with hesitation in view of the frequent rains. The results have dissipated their fears, and the surprising thing is that the Island of Santo, the most humid, has succeeded the best in this new cultivation. Over 691 289 kg. (681 tons) of cotton were exported from the New Hebrides in 1914. The quality is reported to be excellent.

BISMARCK ARCHIPELAGO.—Experiments were made by the German authorities in the Island of Bougainville (Bismarck Archipelago) with Caravonica cotton which gave an exceedingly fine staple of 1 $\frac{3}{4}$ inches in length, described as strong and of good colour.

BRITISH PAPUA.—In 1915, 100 acres were under cotton in British Papua, the product of which, to the value of £3 300, was exported. The Assistant Resident Magistrate of the North-Eastern Division, in his Report for 1914-15, stated that he had obtained a supply of cotton seed, and as

opportunity offered he distributed this among the villages, with instructions as to planting.

Fiji. — In 1880 the cotton crop of Fiji was valued at £30 000 but its cultivation gradually gave way to more profitable products. Efforts have recently been made by the Fijian Government to resuscitate this industry by supplying, free of cost, to the Indian population the necessary seed, and by providing for the purchase by the local Agricultural Department of the cotton harvested. The estimated area under cotton in 1914 in Fiji was 530 acres, as against 24 acres in 1913. The amount of cotton purchased by the Agricultural Department in 1914 and early in 1915 amounted to about 10 000 lb., all grown from seed distributed from the Governmental Experimental Station at Lautoka. It is anticipated that the cultivation of cotton in Fiji will extend amongst the Indians settled there.

TONGAN ISLANDS. — In the Tongan Islands Protectorate, the climate and soil of many parts of the group are said to be particularly well adapted to the establishment of a successful cotton industry, and it is anticipated that before long cotton will be added to the products of these Islands.

TAHITI (Society Islands). — In 1865 and 1866 the cotton crop of Tahiti (Society Islands) was valued at £100 000. Cotton is now, however, but little cultivated in the Society Islands, principally owing to want of labour.

It will be observed that the localities mentioned are scattered throughout the greater area of the South Pacific Islands, and they demonstrate at least that cotton may be successfully grown on a very large scale if the price offered therefor and the labour available offer sufficient inducement.

199 — **Textiles and Fibres of French West Africa.** — See No. 146 of this Review

200 — **Observations on the Cultivation of some Oil-yielding Plants in Indo-China (1).** —

CHEVALIER, A., in the *Bulletin économique de l'Indochine*, Year XX1, New Series, No 129, pp. 300-303 Hanoi-Haiphong, March-April 1918

The author describes observations he made on the oil-yielding plants of Indo-China during his tours there. In addition to the castor-oil plant, the cultivation of which has spread everywhere in Indo-China as a result of the demands of the Supply Service of France (2), the plants which most attracted the author's attention were the coconut, the oil palm and some forest trees.

1) *Coconut* (3). — This is the most valuable tree for cultivation in Cochin-China, Cambodia and North and Central Annam. In the provinces of Gia-dinh and Biên-hoa, in marshy land which at first sight appears suitable to rice only, are several experimental plantations which are doing well. In these marshy soils, rich in humus, the coconut does well so long as it is planted on land sufficiently high above the water level to prevent most of the roots from being soaked. The soil is raised by digging between the rows of coconuts and heaping the earth round the foot of the trees. A series of small, parallel canals is thus made between the

(1) See R. July, 1918, No 762 — (2) See R. Nov, 1918, No 1188. — (3) See No 201 of this Review (Ed.)

coconuts. Sometimes the soil round the foot is raised yet more by adding each year composts and vegetable mould taken from the canals around. This mud, mixed with a little lime, makes an excellent fertiliser. At the beginning of plantation in marshy land and during the three or four first years, the expense of upkeep may be greatly reduced by growing rice in the land where canals have not yet been dug and which is raised only round the foot of the coconuts. As the leaves of the coconuts grow larger and the land is divided into canals and hillocks rice-growing gradually becomes impossible. It is, however, especially in the red soils of Cochin-China and Cambodia that the future of coconut plantations seems most promising.

Methods adopted by natives of Cambodia to control *Oryctes rhinoceros* are described. M. KRT, President of the Court of Cassation of Cambodia, surrounds the upper part of the coconut trunks, especially the axil of the leaves and the parts near the terminal bud, with intertwined, thorny twigs from lianas, very common in the hedges round the village, known locally as "Vœur bae tamnoeup" or "Paula est". These plants are *Acacia pennata* Willd, and a related species as yet undetermined; climbing *Cassalpinia* may also be used. These intertwined thorny twigs stop the insects during their night flights and in the morning the children collect and destroy those which have fallen at the foot of the trees.

M. POUN, Minister of War at the Court of Cambodia, uses a somewhat different method. The upper part of the trunk, especially the axil of the leaves, is surrounded by rice straw instead of thorny twigs. This effectively prevents the insect from boring galleries into the palm. M. MARTIN DE PLANCOURT has observed that if *Canna* is grown round young coconut trees *Oryctes* cannot reach the trunk, and the fallen insects may be collected from the ground every morning.

2) *Oil palms*. — The *Elaeis guineensis*, a native of West and Equatorial Africa is also very valuable in Indo-China. The yields obtained from the few plantation experiments made, although not so high as those in Malaysia, where they are really remarkable, are, nevertheless, worthy of attention. It is essential to introduce good varieties into Indo-China, and it should not be forgotten that oil palms demand much attention.

3) *Forest trees*. — The author had occasion to study the wild oil-yielding trees of the Indo-Chinese forests. Some of them are cultivated by the natives in Tonkin and North Annam. No species of the forests of Cochin China or Cambodia seem adapted to rational exploitation because of the way the trees are scattered through the forests and their low, irregular yield. This applies particularly to *Bassia*, two species of which are known in Cochin-China and Cambodia, and *Schleichera trijuga* (Sapindaceae; wrongly considered by LEUREIRO to be a pistachio tree and called by him *Pistacia oleosa*). An exception should, however, be made for a Myristicaceae plant which is fairly common in the Saigon district and the province of Bienhoa, *Horsfieldia Irya* (Gaerth.) Warburg, found in marshy lands. This tree gives high yields of oil seeds (as much as

110 lb. according to M. GIRARD) which contain up to 50 % of fat. The tree grows fairly rapidly.

201 - **The Coconut Tree in Cochin-China** (1). — I. MORANGE, P., in the *Congrès d'Agriculture coloniale, Gouvernement général de l'Indochine, Bulletin* No 11, Saigon Series, pp. 13-23 Saigon, 1918 — II GIRARD, E., De l'intérêt des cultures intercalaires de caféiers dans les hévéas et dans les cocotiers, in *Bulletin économique de l'Indochine*, Year XXI, New Series, No 129 pp. 150-157

I — In addition to the small crops of coconuts, very common in most of the villages of Cochin-China, there are over 17 297 acres of native industrial coconut plantations in Lower Cochin-China, divided into numerous small estates, generally from 7 to 25 acres in area, and never larger than 75 acres. There are about 2 470 acres of European plantations. These are new, and will not be in full bearing for 5 or 6 years at the least, when their yield will represent 1 500 to 1 600 metric tons of copra alone. In a few years there should be an export not exceeding 8 000 to 10 000 metric tons.

An enquiry made in 1912 showed there to be about 370 660 acres of uncultivated land in Cochin-China which could be utilised for growing coconuts; of these 247 010 are "red soils" (2) and 123 550 alluvial or sandy soils. In addition to rubber trees, it should be possible to grow large coconut plantations in the red soil, of which there are at least 988 440 acres in Cochin-China. This work has been started by the "Société des Plantations" of Au-lôc.

The Administration has attempted to encourage the cultivation of coconut trees and the production of copra. A decree of the Governor of Cochin-China, dated December 11, 1912, laid down sanitary measures for the control of insect pests (*Oryctes rhinoceros* and *Rhinophorus*). In 1913, land on which coconut trees were grown was exempted from all taxes during the first seven years after its cultivation was begun. During the eighth year only $\frac{1}{3}$, and during the ninth $\frac{2}{3}$ of the area are subject to taxation; from the tenth year onwards the whole plantation is taxed. This measure applies to all plantations of at least $2\frac{1}{2}$ acres owned by one person and containing a minimum of 100 palms regularly spaced. The varieties grown must produce copra nuts, not milk nuts.

The trees in European plantations are planted 26 to 33 ft. apart those in Annamite plantations $14\frac{1}{2}$ to 16 ft, sometimes 20 ft, apart; this is too close and is detrimental to the growth and productivity of the trees.

Like all tropical plants grown extensively the coconut needs careful attention, well-prepared soil, seed from high-yielding trees, careful planting at sufficiently large distances (26 to 33 ft.), irrigation where possible, or else dry farming during the season when there is little rain, and control of insects and fungi. A well-kept plantation should yield from 9.5 to 11.9 cwt. of copra per acre, but improved methods should raise this yield to 15.9 cwt. Cochin-China is only a fraction of the part of Indo-China

(1) See No 200 of this *Review* (2) For "Red soils", see No 205 of this *Review*. (Ed.)

where coconut might be grown; this tree has possibilities in both Annam and Cambodia.

II. — The growing of coffee between coconut trees planted, like rubber trees, at at least 30 ft. \times 33 ft. is recommended (1)

202 — **The Hankow Tea Oil (2) Industry.** — CUNNINGHAM, E. S., in *Commerce Reports*, No. 161, p. 134. Washington, D. C., 1918

The product known as tea oil is not produced by the tea plant (*Thea sinensis*), but is pressed from the seeds of *Thea Sasangua* Nois., known as the "ch'a-yu kuo-tzu," a relative of the true tea plant, from which it may be readily distinguished by its hairy shoots. It is a shrub common as a wild plant in the sandstone ravines of north central Szechuan. In parts of eastern China it is abundantly cultivated for the sake of its oil, but in the west the writer only met with plantations in the district of An Hsien. It is, however, reported as being cultivated in the department of Kiung Chou and elsewhere. The oil is used to adulterate colza oil, and by Chinese ladies as a dressing for their hair. The refuse cake is a good fertiliser, and when applied to rice fields is said to destroy the earth worms which often attack the young rice plants. Tea oil is chiefly produced in Hupeh and Hunan Provinces, and it is said that it is offered on the Hankow market to the quantity of about 20 000 piculs (1 picul = 133 $\frac{1}{2}$ lb.) per year. It is stated that there is but one grade, but because some of the oil is not properly settled and drawn off it contains dirt which naturally reduces the value of the oil.

The exports of tea oil from Hankow decreased considerably during 1917 as compared with the preceding four years, as shown by the following figures: 1913, 895 400 lb., valued at \$55 082; 1914, 2 381 000 lb., \$111,481; 1915, 1 917 500 lb., \$98 907; 1916, 1 372 800 lb., \$63 961; and 1917, 712 133 lb., \$44 230

203 — **Vegetable Dye-stuffs of Japan.** — *The Board of Trade Journal* Vol. CII, New Series, No. 1754 pp. 19-20. London January 9, 1919

Great attention has recently been given in Japan to the utilisation of vegetable dye stuffs. The Department of Agriculture and Commerce caused investigations to be made which showed there to be some 60 varieties of trees and 12 varieties of plants suitable for the extraction of dyes. These varieties include:—

Pinus densiflora ("Aka-matsu") Found wild throughout Japan. The leaves yield a dark brown dye used for cotton yarn.

Pinus Thunbergii ("Kuro-matsu"). This gives a dark dye. A factory in the Kagawa Prefecture extracts the dye as follows — to 10 parts of fresh leaves are added 3.3 parts of sulphur and 10 parts of sodium sulphite, and the mixture heated with water for 5 hours. The dye obtained is much in demand.

(1) See No. 205 of this Review — (2) See R., Sept., 1915, No. 910. (Ed.)

CHESTNUT ("Kuri"). — When treated with copper sulphide the bark gives a dye used for saddlery wares. The leaves and bark yield a black used for dyeing silk "haori" (outer garments). The root gives a yellow used for staining furniture, etc

Quercus dentata ("Kashiwa"). — A decoction of the bark gives a khaki colour used for dyeing hemp, cotton, etc

Q. serrata ("Kunugi"). — The leaves collected in September and fermented give both brown and dark green dyes when boiled.

POMEGRANATE ("Zakuro"). The bark yields a leather dye.

Pasania cuspidata ("Shii"). — A dye for fishing nets is extracted from this tree

Camellia japonica ("Tsabaki"). — The leaves when pressed yield a green used for dyeing cheap mosquito nets.

Myrica rubra ("Yamaromo"). — The juice extracted from the leaves and bark gives a dye for fishing nets and a priming for indigo dyeing; it is also used for dyeing khaki uniform cloth

Aleurites cordata ("Abura-giri"), *Quercus Giloe* ("Ichii"), *Juglans Sieboldii* ("Onigurumi"), *Raphiolepis japonica* ("Sharimbai"), etc

Among the plants yielding dyes may be mentioned *Swertia chinensis* ("senbui"), *Lespedeza pilosa* ("Neko-hagi"), and *Coptis* sp. ("Oren").

204 — **American Sumac.** — VELLICH, F. P. and ROGERS, J. S. in *United States Department of Agriculture, Bulletin No. 706 Contribution from the Bureau of Chemistry*, pp. 12 + 5 Tables Washington, D. C., 1918.

Sumac grows wild and abundantly on uncultivated land in the United States particularly east of the Mississippi River, practically the only kinds of sumac gathered are dwarf (*Rhus copallina* L.), white (*Rhus glabra* L.), and staghorn (*Rhus hirta* (L.) Sudw.); the consumption of domestic sumac in the United States was, during the two or three years prior to 1917, more than 10 000 000 lb. annually and the general importation of ground sumac from 10 700 000 to 21 500 000 lb.

American sumac as now prepared for market contains less tannin, and is much inferior in colour to imported Sicilian sumac. Properly gathered and cured domestic sumac leaf contains from 25 to 30% of tannin, practically as much as Sicilian sumac leaf.

Owing chiefly to low quality, due to careless gathering and curing, the gatherer has received in recent years a low price for American sumac, from 60 cents to \$1.10 per 100 lb. Carefully gathered and properly cured Sicilian sumac leaf sells in the United States at from \$2.50 to \$4 per 100 lb. A better product, both in colour and tannin content, is obtained by proper gathering and curing and by the separation of the stalks.

The development of the American sumac industry and the production of bright, uniformly and properly cured sumac can be accomplished only through the earnest and wholehearted cooperation of the buyers and the gatherers. The buyers must make every effort to stimulate the proper gathering and curing by offering better prices and through careful instructions in proper methods of gathering, curing, and packing.

- 205 - **The Rubber Tree in Indo-China.** — I. CHEVALIER, A, Généralités sur l'hévéa, *Congrès général d'agriculture coloniale, Gouvernement général de l'Indochine, Bull. No. 7, Saigon Series*, pp. 3-18. Saigon, 1918 — II. GIRARD, E, Développement et avenir de la culture de l'hévéa, *Ibid.*, pp. 19-28 — III. HALLET, A, Le "clean weeding" et la culture de l'arbre à caoutchouc. *Ibid.*, pp. 29-38. — IV. JACQUE, L., Les plantations d'héveas dans les terres rouges du nord de la province de Thudaumot *Ibid.*, pp. 39-43 — V. MORANGE, R., Notes sur la culture de l'hévéa en Cochinchine, *Ibid.*, No. 11, pp. 1-13 — VI. GIRARD, E, De l'espacement des arbres dans les plantations d'hévéa: de l'intérêt des cultures intercalaires des caféiers dans les héveas. *Bulletin économique de l'Indochine*, Year XXI, No. 129, pp. 218-231. Hanoi-Haiphong, March-April, 1918

I. — MISCELLANEOUS REMARKS ON RUBBER. — The development of rubber growing in Cochin-China is one of the most important events in the economic history of the French colonies; it is the first example of a modern crop cultivated in these colonies on a large scale and, in spite of innumerable difficulties at the outset, its success has exceeded the hopes of even the most optimistic. The oldest rubber plantations in Indo-China, started at the same time as numerous other similar plantations in Malaysia and Ceylon, have been improved by all the methods adopted in the best estates devoted to rubber in the Central-East. Nowhere in the world are there agricultural enterprises better organised or better kept than certain large plantations in Cochin-China. And yet this crop is only in its infancy and what has been done is very little when compared with what remains to be done.

At present there are 49 400 acres of plantations in Cochin-China and about 2 470 in the rest of Indo-China. These crops increase by some 2 500 acres a year, and could increase yet more if more French capital were invested in their development. The oldest plantations were started in 1897, but large estates have been formed since 1907 only. In 1917 the rubber yield was about 800 metric tons. About 5 million trees will be ready for tapping in 1922. Taking the average yield per tree as 800 gm. a total yield of 4 000 metric tons may be expected, and a few years later almost double that quantity may be hoped for from the plantations at present in existence in Indo-China. Most of these plantations are in the eastern provinces of Cochin-China. To the west of Cochin-China, in Cambodia, are large stretches of land which also appear very well adapted to rubber growing, but this district is little colonised.

In Cochin-China soils in which rubber may be grown are divided into "red soils" and "grey soils". The "red soils", of volcanic origin, are very fertile and suited to the cultivation of all tropical plants grown on a large scale. They are found in the north of the province of Thudaumot and in the east of the provinces of Bienhoa and Baria. They cover a large acreage in South Annam and, in Cambodia, at least 2 470 000 acres. Unfortunately they are always far from the large Annamite or Cambodian centres and, as a rule, are inhabited only by a primitive forest population. Labour has to be imported and much difficult clearing work done.

"Grey soils" are nearly always sandy soils derived from alluvion or the decomposition of under-lying sandstone. They vary greatly in composition and fertility. They cover very large areas in Annam, Cam-

bodia, and Cochin-China, where they are used for growing rubber, especially near large centres. They are easy of access and in non-marshy districts. Labour is easy to find and the cost of clearing minimum.

At the outset a rubber plantation in grey soil would, therefore, cost less than one in red soil, but later it would entail higher expenses for fertilisers and maintenance to counteract the low fertility of the soil in some districts. Fortunately rubber is one of the least exacting tropical crops. The author believes it would be possible to obtain a remunerative yield in grey soils and also in the more fertile red soils by intensifying cultivation. Throughout the whole of the Central East the cultivation of rubber is becoming more and more commercial and scientific. It is estimated that those enterprises which can withstand the economic competition after the war will reduce the cost of rubber by increasing the yield of latex per tree and keeping the trees in good condition for an indefinite period.

So far the Cochin-China rubber plantations have been little troubled with disease; this is attributed to the long dry season (1). *Termes gestroi*, a kind of white ant which does serious damage in certain plantations in the Malay States, has not been observed in Cochin-China. *Fomes lignosus* (*F. semitostus*), a fungus related to the polypori, has not been found either. *Botryodiplodia*, *Corticium*, and *Phytophthora*, dangerous fungi, do, however, exist in Cochin-China, though they do little damage. Pink disease, caused by a fungus, *Corticium salmonicolor* (= *C. javanicum*), is found now and again in badly kept plantations; the author observed it on coffee. Although diseases are rare, they may become worse, and should be controlled with the help of a specialist.

There is a great future for rubber in Cochin-China, and the plantations might be largely increased. The Government of the Colony has proved very liberal both in concessions and the sale of estates. In no country in Indo-Malaysia or the Far East are the dues on concessions so small; nor is there any in which the soil and climate conditions are more suited to rubber-growing. Labour is more expensive in Cochin-China than in Ceylon or Java but, when superintended, is in many ways much better. Nor is it lacking; in Tonkin and North Annam are over-crowded districts which need thinning out, either by helping native colonisation of certain districts, or by facilitating the emigration of workers to the plantations. The joining up of Saigon and Hanoi by railway and the subsequent railway between Cochin-China and Cambodia, will greatly help the migration of labour to the districts to be exploited. The Scientific Institute of Giraï (2) will largely help to direct the colonists and natives in the rational maintenance of the plantations.

II. — DEVELOPMENT AND FUTURE OF RUBBER GROWING. — The author discusses the formation of rubber plantations in Cochin-China, the methods of cultivation (clean weeding) of the Malay States and Cochin-

(1) For diseases of rubber trees see "Diseases of *Hevea brasiliensis*", in the *Tropical Agriculturist*, Feb., 1917. (Author.) — (2) See *R.*, Oct., 1918, No. 1068. (Ed.)

China, and shows how promising is the future of rubber growing in the French colony, where it is so well developed

III. — CLEAN WEEDING. — Clean weeding (I), first practised in the tea plantations of Ceylon, was later applied to certain plantations in Cochin-China. This system consists in removing all traces of weeds from a plantation at the time it is formed, and removing all those which appear before they can seed. If the weeding is well carried out, i.e., if no weed, even 2 to 3 cm high, is left, it is enough to hoe every 20 to 30 days, according to the amount of rain which falls, to prevent seeding. When this is done it only remains to remove the very few, very small weeds which are not deep-rooted. In clean land one labourer, or even one woman or a boy, can easily weed $\frac{1}{2}$ to 1 acre a day. This is very economical. For the clean weeding method, however the ground must be well drained as it is impossible to prevent the growth of grass in continually wet parts. Weeds with rhizomes, especially "tiani" (*Imperata*, known as "lalang" in the Malay States), must be removed "'rauh" must be completely obliterated or it entirely prevents the growth of the trees and entails very high expenses for upkeep.

Excellent results have been obtained with clean weeding in the red soils of Cochin-China. The method has not yet been applied to the grey soils, but the author continues to extend it and hopes to obtain the same results. He believes the excellent results so far obtained to be largely due to the permeability of the soil.

IV — RUBBER PLANTATIONS IN RED SOILS (in the north of the province of Thudaumot) — Planting, maintenance, and tapping are discussed successively.

V — NOTES ON RUBBER GROWING IN COCHIN CHINA — The author estimates that in the grey soils the cost per acre till the end of the 5th year would be from £12 to £24 and in the red soils, from £32 to £48. These figures depend on the local conditions and are only given as examples. The results already obtained in the oldest plantations show that the following scale may be adopted in estimating the yield of rubber in Cochin China.

Age of plantation	Yield per acre	
	Red soil	Grey soil
	at	at
5 years	0.79	Trees not tapped at 5 years
6	1.4	0.79
7	2.2	1.42
8	2.7	2.22
9	3.18	2.70
10	3.9	3.18
11	4.77	3.98
12	4.77	4.77

(1) See R. July, 1912, No. 103, (Id.)

Yields exceeding 4.77 cwt. could probably be obtained after 12 years. Fertilisers are necessary in grey soils from the first years of planting and, in red soils, from the beginning of tapping. The tapping methods most generally adopted are the half herring-bone with one or two cuts over $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{5}$ or $\frac{1}{7}$ of the circumference, according to the age of the tree, or $\frac{1}{2}$ spiral, with only one cut on $\frac{1}{3}$ of the circumference. Preference should be given to methods which spare the bark as much as possible yet open the ducts to a sufficient length to assure as regular a daily flow of latex as possible (without being constant throughout one season).

Coagulation, in Cochin-China, is usually done with acetic acid (about 1 gm. to 1 litre of latex), some plantations coagulate the latex by smoking. A new method was tested by M. MAGEN, Director of the Agricultural Service, in 1916. It consists in coagulating the latex by products from the distillation of wood after separating the acetic acid and methyl alcohol. The method has been patented under the name of "liquid smoking". The products are prepared and sold by the Bienhoa Commercial and Forest Society.

VI. — *The spacing of trees and the growing of crops between them*—The great action of the sun on yield makes wide spacing indispensable if high yields are to be obtained rapidly. The proportion of high-yielding trees, 20 to 25 % in close plantation 16 $\frac{1}{2}$ ft. \times 16 $\frac{1}{2}$ ft. in groups of five, rises to 80 to 85 % in plantations in squares 23 ft. \times 23 ft. or 16 $\frac{1}{2}$ ft. \times 33 ft. (Suzannah and Aulôc plantations). The rapid growth of the trees in the author's plantations after the 4th and 5th year when they have sufficient light, led him, after 1913, to limit the number of trees per acre to 40. This number may be yet further reduced if the price of rubber drops, as the old plantations yield more after thinning and are increasingly well cultivated and exploited.

The author recommends the growing of coffee between the rubber trees, in this case the trees should be planted 50 ft. \times 50 ft. or 60 ft. \times 60 ft., or about 11 to 13 trees per acre. Growing coffee during the growth of the rubber trees will make it possible to wait, if necessary, 6, 7, or 8 years before which tapping is not advantageous. For intensive cultivation of coffee trees the author recommends planting in lines 16 $\frac{1}{2}$ ft. apart, the spaces in each line being 6 $\frac{1}{2}$ ft. for Robusta and 5 ft. for Arabica and Lorenzo ("Manilla coffee").

206 **The Rubber Industry in Ceylon.** — *The Board of Trade Journal*, Vol. CI, No. 1137, p. 340. London, September 12, 1918.

The Annual Report of the Blue Book for 1917 shows that the rubber industry continues to thrive and the exports to increase. The area under Hevea is about 251 500 acres, and planting continues. There is a growing tendency among small owners to plant rubber on land formerly used for growing food products, especially in districts where the soil and climate are adapted to these trees. In certain parts of the Western Province rubber is taking the place of cinnamon. In the Kalutara district paddy lands are being converted into rubber estates, thus causing an unfortunate

decrease in the production of foodstuffs. The rubber trees are often badly planted and easily become diseased, these small blocks thus becoming a danger to their neighbours. Such plantations are usually found to involve increased idleness and crime among the cultivators. In the Matara district large areas formerly under citronella (*Andropogon Schoenanthus*) are now planted to rubber.

Extension of rubber planting took place during 1917. In the low country rubber is being interplanted to tea with the object of replacing it, in up country estates inferior rubber is being cut out. Thinning has been continued throughout the island, and estate authorities are giving attention to the treatment of disease. The necessity of inspecting officers to deal with plant diseases and pests has been discussed during the year, and arrangements will soon be made for training such officers.

The average price for all grades of Ceylon rubber sold at the local auctions during 1917 was Rs. 1.49 per lb.

The rubber exports from 1912 to 1917 were (in cwt.) 1912 132,569, 1913, 226,191, 1914, 306,724, 1915 435,748, 1916 486,690, 1917 645,797.

In 1917 the United States imported almost as much rubber as the United Kingdom. The other importing countries were, in order of importance — France, Italy, Russia in Asia, Japan, South America and China. Owing to the war rubber could only be exported to foreign countries under license.

207 — **Lac yielding Trees of Indo China and their Products** (1). — I. CRIVORI C. Les arbres à latex d'Indochine, in the *Bulletin économique de l'Indochine*, New Series, No. 43, pp. 599-65 + 4 figs. Hanoi, July, 1915. — II. IDEM, Note sur les différents produits fournis par l'arbre à latex du Tonkin. *Ibid.* Year XXI, No. 130, pp. 469-470 + 1 fig. Hanoi, Huiphong, May, June, 1915. — III. PRUD'HOMME, I. Note relative à l'emploi de l'arbre à latex d'Indochine. *Ibid.* p. 471.

Lac is a latex obtained by tapping from many trees of the family Anacardiaceae, especially *Rhus succedanea* var. *Dumoultieri* in Tonkin and *Melanorrhæa laccifera* in Cambodia.

1) THE LAC TREE OF TONKIN. — The *Rhus succedanea* Linn. (syn. *Rhus acuminata* D. C.), grows in Indo-China, China (where it is known as "T'si" or "K'i"), Japan ("Haze") and certain mountainous parts of

(1) Lac, which is a latex, must not be confused with "gum lac" or "stick lac" produced by a useful coccid. Lac, properly speaking, is used for covering objects with a shining and very brilliant varnish. Gum is used for widely differing purposes: in the making of alcoholic varnishes, gramophone discs, certain lithographic stones, as well as in electric and other machinery, hat making and cutlery (for fixing the blade to the handle), inferior qualities are used for making sealing-wax, it is also used in painting, for making small objects (especially cheap bracelets in India) and the Annamites varnish their teeth with it to prevent decay. At the Colonial Agriculture Congress of 1914 in France, M. HAUTEFEUILLE, read a paper on *Indo-Chinese stick lac and its commercial treatment* (Colonial Agriculture Congress, General Government of Indo-China, Hanoi Series, No. 12, pp. 49. Huiphong, 1918) this is similar to the paper by the same author in the *Bulletin économique de l'Indochine* in 1915 abstracted in this *Review*, August, 1910, No. 895 (Ed.).

India. In Japan is found, between the 36th and 40th degree of north latitude, another *Rhus*, a native of temperate districts, *Rhus vernicifera*. It is known in Tonkin, Annam and Cochín-China as "cây-son" and in Cambodia as "Kremuôn cham bak" (?). The cultivation of this plant is restricted to the province of Hung-hoa, in Tonkin. The natives grow it in sandy loam, on the slopes of hills, paying no attention to orientation. The seed is sown in September in holes (3 seeds per hole) 5 ft. apart. Six months later, in May, when the plants are 1 ft. high, they are thinned, only one plant being left in each hole. When the tree is two years old, i. e. about 4 ft. high, or when it is 3 years, i. e. 6 $\frac{1}{2}$ ft. high, tapping is begun. The trees are tapped for three consecutive years, after which they are exhausted and are used as fire wood. The cuts are made throughout the year at intervals of two days, at 5. a. m. in summer, and throughout the morning in winter. No incisions are made on wet days. The cuts must not be made in too strong a sun, as this oxidises the latex; nor must rain fall into the latex as its value is thus reduced. The V-shaped cuts are made on $\frac{1}{4}$ of the trunk first on one side, upwards, then on the other side, also upwards. In the Thanh-ba district, in the north of the province of Hung-hoa, where lac trees are abundant, one tree is estimated to yield annually 3 "cái bát" (about 0.3 galls.) worth about 5 $\frac{1}{2}$ d.

Not more than 400 to 500 sq. m. are planted by natives, the acreage is limited to the working power of a family. It is, thus, impossible to calculate the income per acre with any degree of precision.

According to the natives the lac tree is attacked by no insects and suffers from no disease.

The seed is not utilised by the natives. They contain a hard oleo-margarine and are used in Japan, like those of *Rhus vernicifera*, for the extraction of a vegetable wax from which candles are made. In Europe this wax is known as "Japanese vegetable wax" or "Japanese green vegetable laid". It is used for the same purposes in China, but to a much smaller extent. The seed of the Tonkin lac tree could also be used for this purpose.

The latex contains a high proportion of water from which it separates on standing in a closed receptacle; the floating latex is collected with a spoon and is filtered through cotton to remove the impurities. There are two distinct qualities of lac in Tonkin — that of Thanh-ba, province of Hung-hoa, and that of Hung-hoa, the other parts of the province. The natives prefer the Thanh-ba lac which has three grades, Hung-hoa lac having but two. These different qualities are very difficult to distinguish.

2) THE LAC YIELDING TREE OF CAMBODIA. — *Melanorrhoea lanifera* Pierre is known in Cambodia as "dóm kreul", and its product as "me-réak". It is found all over Cambodia and the provinces of Bien-hoa and Thu-dân-Môt, as well as in the island of Phu-quoc, in Cochín-China. In Annam it has been reported from the provinces of Quang-nam and Quang-nai. It is also probably found in the forests in the extreme south of

Annam. The Cambodian provinces providing the most lac for local commerce are those of Kompong-Chuang, Kompong-Thom, and Kompong-Speu. In Siam and Burma a closely related species, *M. usitata* Wall., is exploited.

The wood of *M. laccifera* is known as "false mahogany", and is used in cabinet-making; at Nancy it is called "bois jonquille". The lac ("morak" or "meréak") makes an excellent varnish. In Cambodia there are three qualities, distinguished by their brilliancy. The difference in quality is attributed to the age of the tree, and latex from old trees is that most sought after. The lac is usually sold in jars of 3 ½ néals (about 1 ¼ lb.) at 1.30 piastre (1 piastre = 1 s. 0 ¾ d.).

II. — The daily yield of lac in Tonkin is poured into receptacles (varnished bamboo baskets), and left some time for the varieties to become distinguishable by their density.

A) After 15 days a bluish liquid is found at the bottom of the basket; this is separated from the mass, and used for making a kind of cement with wood shavings.

B) Above is a whitish yellow mass, also watery, but more consistent; this is used for caulking boats, baskets, etc.

C) Above this are two qualities of commercial lac; the lower is the inferior quality, the upper the good quality. The latter should be a not too pale butter yellow, a whitish tinge shows an essential part of its good quality to be already elaborated. It should not contain more than 25 to 30 % of water.

D) In time this essential part comes naturally to the surface. It is oily, chocolate in colour when fresh, chestnut when stale. It is a varnish of extraordinary brilliancy. The value of the lac decreases in proportion as it loses this matter, generally removed with a spoon every month. The elaboration of this matter is very slow, usually taking from 8 months to 3 years, and may continue for 5 years in the same mass of lac.

Of late years the price of lac has increased greatly, because the Chinese exporters offered such low prices from 1910 to 1914 that many planters cut down their trees.

III. — The author describes the comparative and practical tests carried out at Chalais-Meudon, France, for the military Air Service, under the direction of Lieut. GURKIN, on the use of Indo-Chinese lac as a protective cover for aeroplane and airship propellers. The results showed Indo-Chinese lac to form a coating of remarkable resistance and elasticity, superior to all those obtained with the best copal varnishes used in aviation. To complete the study the "Jardin Colonial" of France varnished a number of objects to see whether lac could be used advantageously in surgery, chemical and photographic laboratories, as well as in aviation, cabinet-making and coach-building. The resistance of Indo-Chinese lac to various chemical reagents is also being tested by the use of wooden or cardboard test-tubes, varnished all over.

- 208 - **Propagation of Vanilla by Cuttings.** — *The Agricultural News*, Vol. XIV, No. 338, p. 41 Barbados, 1915, and *L'Agronomie coloniale, Bulletin du Jardin Colonial*, Year III, No. 19, p. 29, July-August, 1915.

Mr. J. JONES, curator of the Botanic Gardens of Dominica, British Antilles, described a method of propagating vanilla by cuttings which seems to reduce the decay of the cuttings after they have been placed in the soil. As a rule when cuttings of vanilla are taken from the parent plant the leaves are stripped from the part which is to be placed in the earth. The wood is kept a few days in the dark, then laid horizontally, at a depth of a few centimetres only, at the foot of the prop. In the method described all the leaves are left on the cutting which is placed in the soil so that the end protrudes. The part in the open air gradually heals up and, as no leaves have been removed there are no scars through which infection can enter.

- 209 - **"Vassourinha de botão" (*Scoparia dulcis*), a Medicinal and Fodder Plant of Brazil.** — *Chacaras e Quintais*, Vol. XXIII, No. 8, p. 400 São Paulo, November 15, 1915.

This Scrophulariaceous plant is very common in the grazing lands of Pernambuco, Brazil. It has deep roots, is very resistant to the heat of the sun, little exacting as regards soil, and flowers from June to August. The crushed whole plant is used against diarrhoea, the juice is used as an enema and the sweetened infusion is taken for coughs and bronchitis. When the grasses dry up it is eaten by the stock; for this reason many breeders leave it on the land.

- 210 - **Graft Hybrid of the Vine, in Italy.** — *Il Nuovo Giornale*, Year VIII, No. 11, pp. 607-608 Casablanca 10 October 17, 1918.

The author describes a case, observed in the commune of Castel di Lama, province of Acoli Piceno, of the transformation of a black muscatel grape into a white grape (keeping the shape and flavour unchanged), as a result of grafting on vines with white grapes.

- 211 - **Re grafting Vines.** — *RAVIZ, I. in La Progrès agricole et viticole*, Year XXXV, No. 14, p. 438 Montpellier, November 10, 1915.

Stock which have not recovered from a first grafting cannot be re-grafted unless they have strong shoots which maintain all their strength. If there are no shoots, or only weak ones, it is best to dig them up and replace them by stronger stock of the same, or stronger, varieties.

- 212 **Stock for Dry Soils.** — *RAVIZ, I. in La Progrès agricole et viticole*, Year XXXV, No. 35, p. 475 Montpellier November 10, 1915.

Dry soils are usually little fertile. Vines which, in such soils, stop growing early, grow less subsequently. In such soil strong stock is necessary so as to counteract in part the infertility of the soil; it is also necessary to have scions suited not to the stock, but to the soil, i. e., vines must be grown which have been used ungrafted. Aramon is a plant doing well in cool, rich soil, and preference is always given to Carignan in poor soils, especially in shelving-beds where it remains strong and gives a high yield. Clairette and Ugni blanc are also suited to such soils, but there is

little advantage in growing them nowadays. The stock used for Carignan may be Riparia, if the soil is of good quality, or 3306 or 3309 if it is poor; 420 A, 33 École, which is very strong, or 161-49 Couderc may be used on condition that they are planted with very good roots as they grow slowly the first year.

213 - **Hardwoods in the Dominican Republic.** - McLFAN, A., in *Commerce Reports*, No 146, p 1123, Washington, D. C., 1918.

Ebony, rosewood, walnut, satinwood, lignum-vitæ, and mahogany are the principal hardwoods found in the northern half of the Dominican Republic. There are also many other valuable woods in this region not so well known to commerce; among them are Mara, Calla Amarillo, Candelón, Aguacatillo, and Algarroba. While most of the hardwoods have been cut out near the coast and along the water courses, it is said that the available supply is greater than that which has been exported. The hardwoods remaining in the district are difficult and costly to get out, owing to lack of transport facilities. If roads were built into the lumber regions, the exports of hardwoods from the territory would no doubt increase considerably.

Hardwoods are usually shipped in the log or mostly squared. While no separate statistics are available, the greater part of the hardwoods exported have heretofore been shipped to Great Britain, with small quantities to Germany and the United States. The exports of mahogany and lignum-vitæ from the Dominican Republic during the past 5 years were as follows:

Year	Mahogany	Lignum-vitæ	Other woods (ebony, walnut, satinwood, etc)
—	—	—	—
	\$	\$	\$
1912	11 738	63 142	51 531
1913	60 913	37 877	5 247
1914	14 249	16 010	35 505
1915	4 991	6 745	52 032
1916	2 312	13 032	41 906

214 **Ash Wood in the Aviation Industry, in Italy.** CUSMANO, C., in *L'Italia in colla d'asana*, Year VIII No 47, p 608 Casalmonferato, November 24, 1918.

In making the frames and wings of aeroplanes and airships preference is given to ash wood because its fibres are fine, compact, strong and with few knots. Ash grows well in the south and centre of Italy, in loose, slightly moist, or even dry soils. Its trunk is straight and exceeds 65 ft. in height. Its leaves can be fed to stock. Large ash plantations should be made in Sicily, Calabria, the Abruzzi, and Tuscany. It is sown in the nursery and the saplings may be planted out after two years. In this way a fine plantation of 18 000 ash trees was made in the convict colony of Castiadas, Cagliari, from 1913-1917; the varieties used were chiefly No. 13942 of the species *Excelsior* and No. 4130 of the species *Ornus* or *mannifera*. As about 720 trees can be plant-

ed per hectare (2.47 acres), in quincunxes, 13 ft. apart, on 1000 hectares, 720 000, and on 10 000 hectares over 7 million can be grown. In Italy at least 10 000 hectares of land are suited to this tree, especially in the mountains. In 25 years, i. e. at the first felling, the trees would bring in, at the rate of £ 1.4 s. each, over £ 7 029 760

- 215 - **Produce of the Forest and Brush of French West Africa: — Rubber, Wood, Gum, Copal, Kola, Palmyra and Doum Palms, Gonakie.** - See No. 146 of this *Review*

LIVE STOCK AND BREEDING.

- 216 - ***Stomoxys calcitrans*, the Agent Transmitting "Mal de Cadera".** — Chacaras e Quintaes Year IX, Vol. XVIII, No. 1 pp. 280-282. São Paulo, October 15, 1918

Stomoxys calcitrans, known in Brazil as "mosquito do café", is very similar in appearance to the domestic fly. It is of one the most terrible blood-sucking insects; it attacks all animals as well as man and, like all blood-sucking insects, it is very dangerous on account of the diseases it propagates. In Brazil it is thought to be the agent transmitting *Trypanosoma equinum* Voge, the cause of the terrible epizootic of the horse called "peste das cadeias". In the Argentine, where it is called "mosca brava", it propagates the same disease, known in Spanish as "mal de cadera" or "surra americano".

Stomoxys calcitrans lays its eggs in straw and horse dung left lying about in which the larva lives; it is, therefore, a very bad practice to spread coffee twigs and fresh horse manure around that plant, as is done in Brazil. On the contrary a compost should be made by mixing them with lime and, during the winter months (June and July), this compost should be dug in round the plants and carefully covered with soil. In this way, not only will the fertilising elements be better utilised, but the propagation of this terrible fly will be checked - a much more important advantage. A law of the province of Santa Fé, sanctioned on October 25, 1886, orders that, 10 days after threshing the wheat or ginning the flax, all the straw not utilised industrially or commercially must be burnt; if this law were applied to the whole of the coffee-growing zone and extended to other kinds of straw as well as to the twigs of that plant, and, above all, if the application of the law were really enforced, a great step would have been taken towards the destruction of the pest.

- 217 - **Prophylaxis of Cattle Plague and Control of Infectious Diseases of Cattle in general, in Erythrea.** - DI DOMIZIO, G., in *Il Moderno Zootecnico* Series V, Year VII, Nos. 1 to 5 Bologna, January 31-May 11, 1918

The Italian colony of Erythrea counts, for a population of 300 000 inhabitants, 500 000-600 000 cattle and 2 million sheep. In Italy, before the war, there were about 6 million cattle for a population of 35 million inhabitants. There is, however, no excess of cattle in Erythrea, as they constitute the chief and often the only riches of the natives, who still hesitate greatly before selling, especially if it is a question of large numbers. This is why, before thinking of utilising the excess of live stock for the

mother country it has to be made certain that this excess really exists. When it has been obtained, it can be transported as frozen or tinned meat, but it will never be worth while to export living cattle from Erythrea to Italy, especially as regards the sanitary police, as the risk would be run of introducing (neglecting the questions as to whether, amongst animals that have recovered from the plague, there may be some carrying virus) several diseases due to trypanosomes (which could be transmitted by the Tabanids and Stomoxyes existing in Italy) such as "surra" (propagated by *Stomoxys calcitrans*, very abundant in Italy), etc.

In 1911 a large park was made at Massaouah to serve as a quarantine station for cattle destined to be exported to Italy and Egypt. Only taking account of the incubation period of cattle plague, the Government of Erythrea decided that the cattle would only remain there 8 days; but, owing to the existence in Erythrea of coast fever and other infectious diseases, the Sanitary Direction of the Kingdom only allowed the cattle to be imported into Italy after a quarantine of 25 days. This sufficed to render it impossible, for a stay of 25 days under the climate of Massaouah, with brackish water to drink, would have reduced the cattle to such a state as to make it not worth while exporting them.

According to the author, vaccination with serum by the method of KOLLE and TURNER (from 1906 to nearly all 1913, 400 000 cattle were treated), far from arresting cattle plague in Erythrea, has rather spread it, judging from the fact that, even in the years of greatest work, it has been almost impossible to vaccinate more than half of the new live stock, thus leaving the other half with its receptiveness untouched; vaccinated stock were not quarantined; the vaccinations were repeated various times, etc. If the infection had been left to follow its natural course, it would have been difficult to have had more serious losses; but it is incorrect to attribute to vaccination the recrudescence of the disease observed in the live stock since 1905, for it had already been observed previously and in greater proportions. The author does not think it opportune to forbid vaccination with serum in Erythrea, where it is difficult, if not impossible, to combat the disease by other means, and where control solely by sanitary police measures would be useless. "Amongst all the present known methods of control of cattle plague", says the author, "that of the active immunisation of live stock by the method of KOLLE and TURNER is still the most suitable for Erythrea, conjointly, of course, with strictly enforced sanitary police measures. But to derive real advantage from the fact that this method immunises the animal for the whole of its life and to diminish its disadvantage -- of transmitting the disease to animals apt to contract the disease -- the *whole* of the live stock existing in Erythrea must be vaccinated with serum with the *shortest possible delay*, while special precautions must be taken at the frontiers, and the operation must be repeated every 3 or 4 years on all the new live stock, always within the space of a few months." In Erythrea, the danger of inoculating diseases caused by protozoa (piroplasmoses, trypanosomiasis, etc.) in the operation of vaccinating with serum (a risk for which the simultaneous method of KOLLE

& TURNER was condemned by KOCH & THEILER) can always be avoided if it is carried out by competent persons; this the author affirms, basing his opinion on the result of about 80 000 vaccinations that he has performed.

218 **Contagious Abortion of Cattle.**— *Agricultural Experiment Station, Kansas State Agricultural College, Circular No. 69, 16 pp. Manhattan, August, 1918*

This circular, published in collaboration with the Extension Division of the Kansas State Agricultural College and the Departments of Veterinary Medicine, Animal Husbandry and Dairy Husbandry of the College, gives the best scientific and practical information available on contagious abortion. Contagious abortion due to a specific microorganism, causes not only the death of the foetus and abortion, but retained afterbirth, and subsequent barrenness. It is spread in the herd by the bull, and by infection of the foodstuff, and from herd to herd by the purchase of diseased cattle. No cure is known. Drugs, such as carbolic acid and methylene blue have proved useless, and vaccines are still in the experimental stage. The disease may be controlled by proper management of the herds, based on three principles: 1) prevention of the spread of the disease; 2) development of herd immunity; 3) treatment of affected animals aiming at recovery and the preservation of reproductive function. In the last case a veterinary surgeon should be called in. Abortion is a self-limiting disease which dies out of itself if the herd is kept intact. Valuable breeding animals should never be sacrificed on account of this disease; aborting cows should be treated, and normal calves raised to replenish the herd.

219 **Stagger Grass (*Chrosperma muscaetoxicum*) as a Poisonous Plant.**— MARSH, C. D., CLAWSON, A. B., and MARSH, H., in the *U. S. Department of Agriculture, Bulletin No. 710, 14 pp. + 8 Figs. + Bibliography of 6 Publications. Washington, September 13, 1918*

Stagger grass grows in sandy soil from Long Island to Florida and as far west as Arkansas. In Virginia it grows at an altitude of 4 000 ft. It had been known for some time to be poisonous but had not been reported as injurious to stock. In North Carolina it has been recognised locally as dangerous to sheep and cattle. The experiments made by the authors on these animals show it to be very poisonous to them. For sheep the toxic dose seems to be 0.06 lb. per 100 lb. live weight and for cattle 2 lb. per 1000 lb. live weight, and the fatal dose 2.2 lb. The symptoms are those of poisoning—increased salivation, nausea, rapid pulse in the acute stage, rapid respiration, slightly low temperature, and weakness. Autopsy shows little change in the organs. The effects of the poison are cumulative, i. e., if eaten on successive days the effects of one day are added to that of the previous one. The plant is also said to be toxic to horses, but not to pigs. The remedial measures are purging and rest.

220 - **Dimensions and Weight of the Body in Relation to the Internal Organs in the "Garfagnina" and "Pisana di Colle" Breeds of Italian Sheep.**— CENSI MANCIA, G. B., in *Il Moderno Zootetro*, Series V, Year VII, No. 7, pp. 138-198; No. 8, pp. 177-192 + 16 Tables + Bibliography of 27 Publications. Bologna, July 31 and August 31, 1918.

The knowledge of the relationships existing between external somatic measurements and live and dead weight, on the one hand, and weight of

the chief internal organs, on the other hand, is not only of scientific value but of practical value because, by elucidating several biological questions it helps to render the selection and specialisation of the breeds of live stock more sure. Profs. PUCCI, REGGIANI, and BRENTANA (1) had already done work on this subject as regards cattle; the author has extended it to sheep. Using 38 sheep of the "Garfagnina" breed (i. e., of the Garfagnana, or upper valley of the Serchio, province of Massa Carrara, Italy) and 12 sheep of the "pisana di colle" breed (Pisan hill breed), all of the same age, he collected a great amount of data, summarised in a series of tables regarding:

Tables 1 and 2: - weight of heart, weight of lungs; live weight; perimeter, length, breadth and depth of thorax; heart indexes.

Tables 3 and 4: - weight of lungs; live weight; perimeter, length, breadth and depth of thorax; indexes of the lungs.

Table 5: - difference between length and breadth of thorax, index of thorax; difference between height and breadth of thorax, height to withers; weight of skeleton.

Tables 6 and 7: - difference between length of trunk and length of thorax; index of thorax; difference between height and breadth of thorax; height to withers, weight of skeleton.

Table 8: - live weight; dead weight, weight of meat; index of thorax, indexes of lungs; indexes of heart; respective relations between live weight, dead weight and weight of meat, on the one hand, and each of the organs, lungs, heart, liver, on the other.

Tables I to VI: - measures and calculations relating to each of the animals studied.

CONCLUSIONS. - In specimens of the two breeds, considered individually, the live weight is independent of the age; on the contrary it generally tends to increase with the maximum age considered.

In sheep of the "Garfagnina" breed, the live weight, dead weight and weight of meat are, on an average, higher than in the "pisana di colle" breed, but, generally speaking there is no fixed quantitative relationship between these values, which are also not in relation with the age.

A greater length of the trunk corresponds to a greater length of the thorax.

The pulmonary indexes and those of the heart depend more closely

(1) As regards the 2 Italian breeds of cattle Val di Chiana and Romagnola, Prof. PUCCI has made the following observations: the index of the lungs increases up to a certain age, then diminishes; the weight of the heart is in proportion to the live weight, on the contrary, however, the weight of the lungs follows this proportion less regularly.

In the Modenese plains cattle, Prof. REGGIANI found that the relations between live weight and dead weight, on the one hand, and weight of lungs, heart and skin, on the other hand, vary greatly and do not serve to distinguish bull from cows. The same may be said of the relations between external measurements of the thorax, on the one hand, and weight of the lungs and heart on the other hand.

For the Schwyz and Parmesan breeds, Prof. BRENTANA found that the weight of the heart and that of the lungs are greater in bulls than in cows. See R., July 1917, No. 617 (Fd).

on those of the lungs and heart respectively than on the measurements of the length and breadth of the thorax.

The various external measurements of the thoracic cage are independent one from another.

The weight of the lungs is not proportional to the live weight and does not depend on the weight of the heart.

The weight of the heart and that of the liver are in proportion to the live weight.

The weight of the lungs, that of the heart and that of the liver are inversely proportional to the dead weight and to the weight of dressed meat (muscles).

The weight of the heart is more directly proportional to the thoracic perimeter than the weight of the lungs.

The development of the thoracic viscera is especially favoured by a greater breadth and perimeter of the thorax.

A greater height to the withers indicates a heavier skeleton.

In animals of the same species, the weight of the skeleton is inversely proportional to the live weight, as has been shown by the researches of LAWES & GILBERT as well as those of DECHAMBRE (1).

The results of the author's observations agree with those obtained by Prof. PRECI for cattle.

Other interesting data obtained by the author are given below :

	" Garfagnina " breed	" Pisana di colle " breed
Quantity of wool (washed on animal) obtained by 2 shearings per year.	1.2 kg ; medium quality	1.2 kg., mediocre quality
Average yield of meat	55.1 %	50.2 %
Average percentage of dressed meat (muscles)	43.6 %	37.6 %
Average weight of crania' bones	0.40 kg	0.30 kg
Weight of skeleton as a percentage of the weight of meat	11.7 %	12.6 %

221 — **Chestnut Leaves as Food for Stock** (2). — D. MERCIUS, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol IV, No 27, pp 755 756 Paris, 1918

The author refers to an experiment he made in 1893 in which he fed 25 cattle on chestnut leaves, in a byre in Périgord, throughout the winter when the feeding of these animals was very difficult. He thinned a chestnut plantation in summer, while the leaves were still green. The young trees were kept in a cool, dark, well-ventilated cellar till December, when the small branches were cut and fed to the animals dry or cooked.

There are disadvantages in feeding chestnut leaves to cattle as they have a heating effect which should be counteracted by plentiful watery food. This difficulty was overcome by boiling a part of the leaf ration and adding a

(1) See R., March 1918, No. 321. (Ed.)

(2) See R. Oct., 1918, No. 1136 (Ed.)

few turnip leaves to flavour it. In February and March ensilaged maize fodder was given in addition to the chestnut leaves. The animals in this byre were in excellent condition for winter work and realised profitable prices at the spring fairs.

222 — **Coffee Dregs as a Food for Stock** (1). — ARUCH, R., in *L'Italia agricola*, Year I, V, No. 10, pp. 299-304. Piacenza, November 15, 1918

The composition of coffee dregs compares well with that of maize, coarse bran, oats and rice bran ("pula di riso"). Two samples of dregs from the second infusion analysed by the author gave the following percentages: — water, 9.45, 11.42; fat, 11.64, 12.45; nitrogen, 11.68, 11.5, caffeine, traces; starch, 17.00, 22.47; sugar, traces; ash, 1.71, 2.03; nitrogen-free extract (2nd sample), 14.81; fibre (2nd sample), 25.30

The author fed coffee dregs to dairy cows, beef steers, horses, rabbits, guinea-pigs, chickens and ducks. The food proved excellent for all the animals when fed powdered (not in grains) and very dry. A cow may consume 2-2 lb. per day, a beef steer 3-3 lb., a horse may receive 1.7 lb., but it is best not to give it more than 0.8 lb. The dregs are, particularly well suited to cows (they favour milk production and improve the composition), and pigs (which digest best the fat of the dregs)

223 — **Horse breeding in Galicia, Spain.** — HERNANZABER, J. M., in *El Cultivador moderno*, Year VIII, No. 12 pp. 11-12 + 5 Figs. Barcelona, December, 1918

In 1918 the "Asociación general de ganaderos" (General Association of Breeders) of Spain organised four horse-shows in Galicia, taking advantage of the subsidy offered by the Ministry of War for the improvement of horses. These four shows, each held for the respective "comarca" at Azua, Betanzos, Ortigueira and Lugo, were really test shows held to gain some idea of the present state of horse breeding. Three Galician breeds were found to be worthy of encouragement.

The Royal Stud for stallions at León has helped to produce several good mares more than 14 hands high called "yeguas leonesas" (León mares). On account of the different breeds from which the improving stallion is derived these mares are difficult to describe. They are mostly used for breeding mules and the stallion is used only when they abort or lose a mule by the disease known as "mal de la sangre de los mulares" (blood disease of mules). They belong to landowners who have abundant fodder; during a great part of the year they are kept in the stable and are turned out to graze in good meadows from time to time. Army remounts could be obtained from these mares and the government should form a dépôt for breeding foals in Galicia. As young mules cost more than foals private owners usually prefer to breed mules.

The second group of Galician horses is the "jaca gallega" type, about 53 in. high, strong, resistant, quiet, bony, defective in carriage, with large

(1) See also: MASONI and SABINI, Quantità di azoto e fosforo nelle acque di coltura di alcuni alimenti vegetali, *Le Stazioni sperimentali agrarie italiane*, Vol. XI, Pt. 9-12, pp. 362-414. Modena, 1918 (Ed.)

head. It is the horse used on medium-size farms in the districts where pasture land is shrubby (broom). It is used as a draught, saddle, and pack-saddle animal. Many of the mares are used for breeding mules. The value of these horses lies in the cheapness of their feed; while they are working they are fed hay, maize and barley; while they are not working they are left to graze in the woods. By serving a mare with a stallion of the same type, but higher, a good army saddle horse could be obtained. During the war these horses have been exported in large numbers.

The third group consists of the Galician ponies, with concave profile, small head, short body, small legs, thick mane and nervous temperament. They are used by the small farmers and live by grazing the broom. They are used as saddle horses, rarely as light draught animals. They are largely exported to France and the other provinces of Spain. The improvement of this race should be encouraged by offering prizes for stallions with good points and good foals descended from these stallions.

221 - **The Sardinian Horse.** — Rossi, in *Giornale d'Ippologia*, Year XXVI, Nos. 19-23, Pisa, October-December, 1918

Sardinia is a very important horse breeding centre. The environmental conditions there make horses indispensable. At first sight the Sardinian horse calls to mind the Arab horse, its height, flanks, back, head, eye, colouring, loins and carriage are the same as in the Arab horse, but the Sardinian horse differs in having a narrow, often curved, breast, flat shoulders, knees turning in, and narrow, small houghs. These defects are caused by the mountainous country in which good fodder is lacking during several months in the year. The coat is generally grey or chestnut. The Sardinian horse is of Arab origin and both by its characteristics and the use to which it has been put it is a saddle horse; it can, therefore, only be improved by using Arab stallions. As good Arab stallions are rare and their importation difficult it is often better to use Sardinian-Arab half-breds. Selection alone also suffices for their improvement. The Royal Studs of Ozieri, the breeding stud of Bonorva, and numerous private breeding studs in Oristano, Macomer, Ploaghe, etc., are important horse breeding centres.

The Royal Stud of Ozieri has 124 Sardinian-Arab and Anglo-Arab stallions. A few of these stallions are rather high in the leg, but most of them have very uniform characteristics, the same nature and the same carriage. Each year about thirty stallions descended from the best Sardinian mares are presented to the Permanent Commission, and about a dozen are selected. The horse production of the island is increasing; the number of mares served by the State stallions has increased continually since 1913, and in 1918 was 49. The purchase of stallions for the royal stables and the private production of stallions are also of growing importance. There are 18 stud stations for the selected mares, which number 600. A commission composed of a veterinary surgeon and the Director of the stud inspects the mares of owners desiring it, and if the mares are judged suitable for free service they are inscribed in the pedigree book of the Royal stud of Ozieri and a record kept of the births, abortions, sales, etc. The foals of select-

ed mares are examined by the Commission at the end of six months and a year and a half. The owners of selected mares receive different awards accorded by the decree of June 9, 1916, one of £ 6 per year for the mare, one of £ 2 for each foal born alive and healthy, one of £ 4 for each foal of two years suitable for future use as a stallion, and one of £ 4 for each filly suitable for future use as a breeding mare if the owner undertakes to enter it among the selected mares. Foals judged suitable for use in the government studs are bought for not less than £ 160. The best two year old foals of the island, all destined for the cavalry, are kept at the Bonorva breeding stud. The average number of foals purchased annually by the Remount Commission is 600. When they are three years old the foals at Bonorva are sent to the Grosseto stable, where they are kept till fully grown. Special mention should be made of the mares of the Burgos breed (district in Sardinia) in the Bonorva breeding stud; they are fine animals, of medium size, but very broad, served by a special stallion. Their foals are good but a little high in the leg.

225 - **Marine Algae as Food for Horses.** — LAPICQUE, L., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVII, No. 27, pp. 1082-1085. PARIS, December 30, 1915.

During 1917 M. ADRIAN attempted to use certain marine algae as a food for war horses with very promising results (1). In collaboration with M. BARBI, and Lieut. POWICK of the American army, the author studied the preparation of the algae used by M. ADRIAN to determine. 1) their digestibility, 2) their food value, 3) their harmlessness. The algae used were *Laminaria* (almost exclusively *Laminaria flexicaulis*). They were first dried, then well washed, a little lime or acid being added to the water to prevent transformation into mucilage; both the methods give about the same product with a very high ash content — about $\frac{1}{6}$ of the dry matter.

1) Algae washed with lime and fed in small pieces at the rate of 1 kgm. (2.2 lb.) a day at first seemed completely indigestible. After passing through the horse's digestive tract (after 2 or 3 days) they were found in the faeces without having changed or decreased perceptibly. After the following day, however, they gradually lost their consistency and were reduced to mucilaginous clots which totally disappeared in the faeces corresponding to the sixth day of the diet.

Algae washed with acid reappeared in the faeces in a similar way, but disappeared more rapidly. The same horses were, however, used in both experiments, there being but a short interval between the two diets. The results showed that, after rapid adaptation, digestibility is excellent, perhaps 100 %.

2) In the case of horses at rest (1 hour's exercise) being fed a strictly maintenance ration, all the oats may be replaced by algae. When at light work (pulling a tumbrel for two hours on a paved road) a good nutritive equilibrium may be obtained with 1500 gm. of algae and 500 gm. of oats (in addition to hay and straw). The oats cannot, however, be satisfactorily replaced by apple residue.

(1) See R. March, 1918, No. 320. (Ed.)

The nutritive equilibrium is known to differ for a maintenance diet and a working diet. Oat are essential in a working diet, during rest they may be replaced by hay or apple residue. The last substitute, a cellulose residue of a fruit deprived of its sugar, is a characteristic case. Glucose, essentially the physiological food for muscular work, is contained in the starch of oats, and the preparations under consideration do not appear comparable to oats in this respect.

3) The preparations cause an excessive formation of minerals, and the urine of the animals eating them contains an extraordinarily abundant deposit of calcium carbonate as well as as much as 1 gm. of iodine daily. All attempts to decrease this mineral content by fresh washing, even when strongly acid, failed; the minerals form part of the tissues and only disappear with the organic matter with which they are combined. Nevertheless the author observed no mishap arising from the use of these preparations, even when prolonged, at the rate of 2 kgm. to 2.5 kgm. per day. A horse of 880 lb. consumed 140 kgm. of these algae in 96 days without any visible bad effects. The only mishaps occurred in the case of horses which had eaten *Fucus serratus*.

In July the author went to the sea to study the problem at its source. His attention was immediately drawn to the excretion of sugar which occurs as soon as the algae leave the water, giving rise to remarkable efflorescences. In preparing the algae for food attempts were made to lose as little as possible of this matter. As washing is indispensable to remove the hygrometric salts plants as fresh as possible were washed quickly so as to take advantage of the difference in the speed of diffusion of the soluble salts and carbohydrates. Unhoped-for results were obtained with the following method:—

Laminaria flexicaulis freshly gathered in August and September, if soaked for a quarter of an hour in dilute milk of lime (4 to 5 gm. of CaO per litre) rinsed a quarter of an hour in fresh water and dried in the air, is no longer hygrometric and keeps like hay. By building a cement basin at the mouth of a small stream the author succeeded in preparing large quantities. The moisture content of this preparation remained at between 15 and 18 %, it contained only 10 to 12 % of ash, and, most important of all, $\frac{2}{5}$ th of the dry matter was composed of a soluble carbohydrate which hydrolysis changed totally to glucose. This carbohydrate is SCHMIEDBERG's "laminarine", which has been the subject of an important study by the Swedish botanist KYLIN (1).

The question of the good value of the algae is totally changed. The careful and prolonged washing of the products originally supplied to the author had removed the most nutritive substance and reduced the algae to the same condition as apple residue; not more than 3 % of soluble sugar was found instead of 40 % or more. The material prepared by the author is being examined chemically and physiologically. The seasonal variations, which ap-

(1) Untersuchungen über die Biochemie der Meeresalgen. *Zeitschrift für physiologische Chemie*, Vol. LXXXIII, p. 171, 1913 and Vol. XCIV, p. 337, 1915. (Author)

pear very important, will also be studied and the different species of algae compared. *L. flexicaulis* has already proved the best species. During the war it would have proved invaluable and will be valuable during the transition period and even when production becomes normal again. Without any expensive installation and the use of peasant labour it may supply the equivalent of 1 million quintals (1) of oats per year.

22b - **Moroccan Draught Oxen.** — IEROY, A, in *Comptes rendus des Séances de l'Académie d'Agriculture de France* Vol IV No 35, pp 965-969 Paris, November 13, 1918.

The presence of several draught oxen from various districts of Morocco at the agricultural competition held at Casablanca in October, 1918, made it possible to compare the work of which animals belonging to the local unimproved breeds are capable with the average work done by French oxen. To do this the effort and maximum speed of the oxen, as well as their average strength, was measured by RINGELMANN's method (2).

The maximum speed was determined by the duration of displacement of each ox without load or harness over a distance of 164 ft. The maximum effort was measured by the use of a collar, strong chains and a dynamometric spring attached to a waggon loaded with 11 metric tons, fitted with a hand brake on a 1.9 ft. railway, 262 ft. long. The cart was started with the help of about 10 men. Once started the cart was stopped by gradually tightening the brake and the maximum lengthening of the spring under the impulsion of the animal at the moment of stopping was determined. A curve, drawn up before the tests, made it easy to estimate the tension in kilogrammes corresponding to the lengthening measured.

The animals were also weighed, their height to the withers measured and their age verified by their teeth.

RINGELMANN's coefficients were used to determine the average strength. If the maximum effort and maximum speed of a given animal be represented by F and V , its average utilisable strength may be calculated by the formula:— average strength = $0.25 F \times 0.33 V$, the effort made during a normal period of work being considered equal to $\frac{1}{4}$ of the maximum effort and the harnessed speed equal to $\frac{1}{3}$ of the speed of the animal without harness or load on a horizontal road.

The author's experiments showed:

1) that Moroccan draught oxen, whose weight varies from 790 lb. to 1210 lb., are about half as strong as good French draught oxen of the Limousin and d'Aubrac breeds;

2) that as a result of better feeding and care, the oxen of European colonists are stronger than those of the natives;

3) that, contrary to the accepted theory, oxen crossed with zebus are no stronger than pure-bred oxen; the zebu crosses were, however, the only ones in the group that had not finished growing. New tests with more animals will make it possible to state definitely the influence of crossing with zebus on the improvement in the working capacity of the native oxen.

(1) 1 Quintal = 1.968 cwt (Ed)

(2) See *Annales de l'Institut National Agronomique*, S. 11es 2, Vol VI, pp 243-279 (Author).

It is not possible to substitute the European plough for the native plough drawn by two animals unless oxen with greater strength than most of the present ones are used. The introduction of modern agricultural implements is, therefore, connected with the improvement of the local varieties of oxen by rational feeding and the selection of breeding animals.

227 - **Wintering and Fattening Beef Cattle in North Carolina, U. S. A.** - WARD, W. T., CURTIS, R. S. and PIVEN, F. F., in the *U. S. Department of Agriculture, Bulletin No. 628*, 53 pp. + 8 Figs. + 26 Tables Washington, January 28, 1918

This bulletin gives the results of 3 years' experimental work on cattle breeding in the west of North Carolina undertaken by the Animal Husbandry Division of the U. S. Department of Agriculture in cooperation with the North Carolina Agricultural Experiment Station. The results may also be applied to the mountainous districts of the surrounding states.

I. — **WINTERING STEERS PREPARATORY TO GRAZING ON PASTURE.** — In the mountainous district the cattle are usually kept on very light rations during the winter and put on pasture the following summer. The authors examined the cost and methods of wintering cattle, the advisability of allowing steers to lose weight during the winter, and the effect of wintering on the gain in live weight during grazing the following summer. The experiments were made during 3 years with 4 lots of cattle containing 24, 24, 33 and 19 steers respectively. As winter ration the first lot received ear maize, maize stover, hay and straw, the second and third maize silage, maize stover, hay and straw, the fourth were winter-grazed and fed dry roughage and ear maize during snowy weather only.

In the 3 years the wintering of Lot 1 cost on an average \$ 11.13 per head. Each steer lost on an average 32 lb. each winter, and the advance in spring cost over the initial cost per cwt. was \$ 1.74. The respective figures for the other lots were: — Lot 2, \$ 7.11, 51 lb. \$ 1.40 per cwt.; Lot 3, \$ 6.76, 52 lb., \$ 1.47 per cwt.; Lot 4 \$ 5.39, 20 lb. (gain), \$ 0.68 per cwt. In this lot the average acreage required to winter a steer was 2 acres.

II. **WINTER GRAZING OF STEERS.** The second experiment dealt with the winter grazing of steers in cleared mountainous land too steep for any other purpose. The coves and flats were sown with a mixture of 15 lb. orchard grass, 4 lb. blue grass and 7 lb. timothy and clover per acre following on maize (winter fodder) which had succeeded grain maize. Each year the cattle were taken to the grazing land towards the end of autumn and left there throughout the winter without shelter. They were given food in bad weather only.

During the first year 17 steers cost an average of \$ 4.66 per head, and in spring weighed 17 lb. per head more than at the beginning of winter. The second winter 26 steers cost \$ 6.29 each to winter and gained \$ 17. The average cost per head for the 3 years was \$ 5.39, or approximately half the cost of dry-feeding in barns, moreover there was a gain in weight instead of a loss. In these mountains winter-grazing and silage give better results than the old method of wintering with dry, cut fodder.

III. — **SUMMER FATTENING OF STEERS.** — This experiment, lasting

3 years, was made with steers which had been wintered on dry roughage, dry roughage, silage, or winter pasture. Most of the mountain animals are fattened on pasture; those used in the experiment were put on grass only or on grass with cottonseed cake. During the first two summers the addition of cake was profitable, but not the third year, owing to the high price it had reached.

The results showed that animals which had been winter grazed gained most the following summer - an average of 330 lb. per head at a cost of \$ 0.031 per lb. The next best gains were made by steers fed silage, stover and hay during the winter and grass during the summer. The average gain in weight during the summer was 357 lb. per head at a cost of \$ 0.038. Animals wintered on roughage and pastured the following summer gave during the summer an average gain in weight of 378 lb. per head at a cost of \$ 0.048. Steers fed silage during the winter and grass and cake during the summer gained 379 lb. at a cost of \$ 0.065, whereas without cake the cost was \$ 0.038. Steers wintered on roughage and fed grass and cake in summer gained 345 lb. at a cost of \$ 0.074.

IV. -- WINTER FATTENING OF STEERS. In the mountain districts it is customary to sell the steers in autumn as feeders. For fattening, feeds such as maize, hay and straw are used. The experiments aimed at determining the most advantageous use of these feeds when home-grown and when cottonseed meal and cottonseed hulls were added.

During the winter 1913-1914, 12 steers were fed on cottonseed meal cottonseed hulls, maize stover, and hay. A second lot of 12 steers received the same ration plus ear maize. In 113 days the steers of Lot 1 gained an average of 1.36 lb. per head daily at a cost of \$ 13.32 per 100 lb.; and Lot 2, 1.42 lb. at a cost of \$ 13.92 per 100 lb.

During the winter 1914-1915, 4 lots of 10, 10, 21 and 26 steers respectively were fed on cottonseed meal with the addition of ear maize and cottonseed hulls for Lot 1, cottonseed hulls for Lots 2 and 3, and maize silage for Lot 4. The steers of Lots 1, 2 and 3 were fattened during 96 days, those of Lot 4 during 111 days. On an average those of Lot 1 gained daily 1.61 lb. per head at a cost of \$ 12.96 per 100 lb., Lot 2, 1.42 lb. at a cost of \$ 11.21, Lot 3, 2.07 lb. at a cost of \$ 7.60, and Lot 4, 1.43 lb. at a cost of \$ 9.40.

From the two years' tests the authors draw the following conclusions applicable to local conditions: Hay increases the cost of fattening and should be replaced by cheap roughage wherever possible. Ear maize increases the gain in live weight and improves the finish, but its use is not advisable unless its cost is much less than that of cottonseed meal. The gains obtained with maize silage were remarkable, showing the value of this plant for ensilage. Cottonseed meal and hulls were satisfactory, even in small quantities, giving economical and satisfactory gains.

The loss in weight during transit was heavy in all cases. Farmers who have a surplus of feeds, especially roughages, may profitably fatten steers during the winter so long as the animals and cottonseed meal can be obtained at reasonable prices and the markets are not at too great a distance.

228 - **The Milch Goat in California.** — WOODHIES, F. C., in the *University of California Publications, College of Agriculture, Agricultural Experiment Station, Berkeley, Cal., Bulletin* No. 285, pp. 87-114 + 13 Figs. + Bibliography of 8 Publications. University of California Press, September, 1917.

This bulletin contains: -

1) General information on the different breeds of goats in California (Toggenburg, Saanen, Nubian or Anglo-Nubian. 2) The composition of goat's milk. The analyses made at the New York Agricultural Station at Geneva showed the average and the minimum and maximum percentages (the two last in brackets) to be: Fat, 3.82, (1.80, 8.40); total solids, 12.12, (9.22, 17.63); total proteins, 3.21, (2.24, 5.21); casein, 2.40 (1.56, 4.06); ash, 0.55 (0.40, 0.80); specific gravity 1.0294. The analyses made at the Agricultural Station of Berkeley, California, showed: — water, 88.05, (85.20, 91.50); total solids, 11.95, (9.50, 14.80); fat, 3.40, (1.70, 5.60) fat-free solids, 8.55, (7.80, 9.20). 3) The utilisation of goat's milk (direct consumption, cheese-making, condensed milk, iced milk, iced cream, butter for home use). 4) Immunity to disease (Malt fever is so far unknown in California). 5) Care and breeding of goats. 6) Future possibilities of goat breeding in California. 7) Results of experimental observations made at the Berkeley Agricultural Station on five Toggenburg goats. The totals obtained for the five goats during periods of 310, 312, 245, 330 and 336 days respectively were: — Average live weight during the observation period, 104, 127, 119, 95, 86 lb., milk yield, 1 283.3, 2 158, 1 118, 1 553.2, 1 341.6 lb.; percentage composition of milk — solids, 12.88, 11.9, 12.37, 11.3, 11.3; fat, 3.88, 3.37, 3.64, 2.89, 2.88, food consumed, 1681 lb. of grain + 648.6 lb. of alfalfa hay + 2556.6 lb. of fresh alfalfa + 77 days of pasture; 615.6 lb. of grain + 672.7 lb. of alfalfa hay + 2147.9 lb. of fresh alfalfa + 74 days of pasture, 28 lb. of grains + 682.6 lb. of alfalfa hay + 2556.5 lb. of fresh alfalfa + 14 days of pasture, 435.7 lb. of grain + 961 lb. of alfalfa hay + 119 lb. of fresh alfalfa + 164.5 days of pasture, 301 lb. of grain + 907 lb. of alfalfa hay + 94 lb. of fresh alfalfa + 175 days of pasture; total food units supplied by the rations, 862.4, 1 264.2, 2 642.0, 1081.4, 933.0; total units per 100 lb. of milk, 67.2, 58.5, 57.4, 60.6, 68.1, total units per lb. of milk fat, 17.3, 17.3, 15.8, 24, 24.1.

The grain rations administered included. — 1) barley, wheat bran, dried beet pulp, and coconut oil meal in equal parts by weight; 2) dried beet pulp (6 parts), barley (1 part), wheat bran (1 part) and coconut oil meal, (2 parts); 3) dried beet pulp, wheat bran, oats, and coconut oil meal in equal parts, 4) dried beet pulp (3 parts), barley (1 part) and wheat bran (1 part). Taking the following unit prices per ton of foodstuff; — barley \$29.5, maize \$29.5, oats \$34, cottonseed cake \$38.5, coconut oil meal \$24, dried beet pulp \$22, wheat bran \$27, alfalfa hay \$10.5, fresh alfalfa \$2.5, pasture \$0.20 per head per month, the cost of foodstuffs per gallon of milk produced was 6.4 cents, and the cost of foodstuff per lb. of butter produced, 22.9 cents. On an average, for 73 cows observed at the same station, the cost of foodstuffs per gallon of milk produced was 83 cents. The production of goat's milk is, therefore, much more economical than that of cow's milk.

229 - **Digestion Experiments Made on Pigs in Illinois, U. S. A. with Special Reference to the Effect of One Foodstuff on Another and the Individuality of the Pigs.** — GRINDLEY, H. S., CARMICHAEL W. G., and NEWLIN, C. I., in the *University of Illinois Agricultural Experiment Station, Bulletin No 200*, pp 56-94 + 4 Pigs. Urbana, Illinois, May, 1917

The objects of the experiments described were: — 1) to determine the influence of one foodstuff on the digestibility of the nutritive matter of another foodstuff; 2) to study the individuality of the pigs with respect to the degree to which they digest their food; 3) to determine the coefficients of digestibility of the food elements of the following six rations. — wheat middlings, ground maize ground barley, wheat middlings + ground maize (1 1), ground barley + ground maize (1 1), tankage + ground maize (1 7.5). The pens used sufficiently large for the pigs to turn in them easily, were raised 3 ft above the ground so that the urine could run away easily. The faeces were collected in rubber-lined canvas bags fixed on to the animal by a special harness joined to a collar (a figure shows this arrangement, plans of the feeding boxes are also given)

Each ration was fed during two periods of 10 days each. Each experimental period was preceded by a preliminary period of 25 to 32 days, during which the pigs became accustomed to the experimental rations, the boxes and the bags and adjustment. In each experiment four 7 month pigs were used. During the 1913-1914 experiments Berkshire x Chester White crosses of equal size were used during the 1914-1915 experiments Duroc Jersey x Poland China crosses also of equal size. The analyses of the foodstuffs and excrements are given in tables. Table I summarises the coefficients of digestibility of the experimental rations. —

TABLE I *Coefficients of digestibility of the rations fed.*

Ration	Number of experiments	Dry matter	Nitrogen free extract	Crude fibre	Crude protein	Other extract
Middlings	16	74.4	81.1	21.0	80.0	85.4
Ground maize	16	87.1	92.1	34.8	74.5	68.3
Ground barley	8	70.8	81.2	14.1	54.0	33.0
Middlings + ground maize (1 1)	8	79.1	85.9	12.1	77.3	83.4
Ground barley + ground maize (1 1)	8	80.9	88.9	15.0	66.3	67.6
Tankage + ground maize (1 7.5)	16	86.0	92.2	1.2	4.8	80.8

After examining the influence of one foodstuff on the digestibility of another as shown by these experiments the authors conclude — 1) that the coefficients of digestibility of foods calculated indirectly by subtracting the weight of the digestible nutritive elements of one foodstuff (determined directly during other periods) from the corresponding values for the two foodstuffs together, may be, and probably often is, decidedly inexact. 2) that the weight of the digestible nutritive elements of a mixed ration (calculated by the coefficients of digestibility of the foodstuffs, obtained directly for each of the foodstuffs given alone) may be decidedly inexact.

This shows that to obtain exact results concerning the coefficients of digestibility of mixed rations direct experiments must be made with the mixed rations

Table II gives data on the influence of one foodstuff on the digestibility of the nutritive matter contained in another foodstuff

TABLE II *Influence of one foodstuff on the digestibility of the nutritive matter contained in another foodstuff*

Ration	Number of experiments	Dry matter	Nitrogen free extract	Crude fibre	Crude protein	Other extract
Middlings, direct determination	8	14.7	82.2	22.8	79.3	82.3
Middlings, indirect	8	70.7	71.2	6.1	78.3	89.3
Maize, direct	8	57.5	92.	30.8	75.1	71.7
Maize, indirect	8	83.7	88.9	- 2.2	73.0	81.3
Barley direct	8	70.8	81.2	14.1	54.6	33.0
Barley, indirect	8	76.1	86.2	3.7	60.2	68.9
Maize direct	8	56.2	91.5	38.8	74.0	64.9
Maize, indirect	8	91.5	96.6	15.6	81.4	68.7
Middlings + maize direct determination	8	19.1	56.0	12.1	71.3	83.5
Middlings + maize, indirect determination (1)	8	81.1	88.1	24.8	76.0	78.8
Middlings + maize indirect determination (2)	8	77.1	83.5	- 0.7	76.6	88.8
Barley + maize, direct determination	8	86.0	55.9	15.0	66.5	67.8
Barley + maize indirect determination (1)	8	76.5	56.3	2.4	63.2	54.0
Barley + maize indirect determination (2)	8	55.2	91.3	6.6	69.9	80.7

(1) Calculated by the *direct* determinations of the coefficients of digestibility of each foodstuff

(2) Calculated by the *indirect* determination of the coefficient of digestibility of each foodstuff

Other tables show the extent to which each pig digested its food. The authors conclude that under the practically identical conditions during the whole experiment the coefficients of digestibility of the nutritive element of a series of different rations show distinctly higher values for some pigs than for others. The differences in the coefficients of digestibility of the nutritive elements of one foodstuff for different pigs are however probably too small to be of great practical or economic importance if of any importance at all.

230 - **Proportions of Supplements to Maize for Fattening Swine in Ohio, U. S. A.** — ROBINSON W. L. in the *Ohio Agricultural Experiment Station Bulletin* 516 pp. 57 Wooster Ohio September 1917

Although it has been proved that in fattening pigs the best results are obtained when maize is supplemented by other foodstuffs the best pro-

portions in which to mix the rations have never been exactly determined. The object of the experiments described was to determine the most favorable proportions in which tankage, ground soy beans, linseed oil meal, and skim milk should be added to maize for fattening pigs.

In the 1st. experiment three lots of 5 pigs were fed for 16 weeks on ground maize and tankage as soon as they were weaned. In Lot 1 50 parts by weight of tankage and 481 parts of maize were fed. In Lot 2 0.36875 lb. of tankage were given. Lot 3 received decreasing percentages of tankage beginning by 20 % the first week and ending by 5 % the last. The results differed little, but were most favourable in the 1st and 3rd tests.

In the 2nd. experiment of 16 weeks' duration made with three lots of 4 pigs of an average initial weight of 57.5 lb., the pigs fed tankage in weekly decreasing quantities showed a greater increase in live weight and consumed less food per unit of gain than those receiving definite proportions of tankage and maize or a constant daily quantity.

In the 3rd. experiment, lasting 16 weeks, with two lots of 4 pigs of an average weight of 75 lb., Lot 1 was fed maize and tankage in the ratio of 8:1, and Lot 2 tankage in percentages decreasing weekly from 20 to 5. The results obtained were the inverse of those of the two first experiments, definite quantities of tankage gave greater gains and smaller consumption.

The 4th. experiment lasted 20 weeks. Thirty pigs of an average weight of 47 lb. were divided into 6 lots fed small, medium or abundant tankage rations as a supplement to maize (i.e., in the small ration about $\frac{1}{4}$, in the average one about $\frac{1}{2}$ of that of the abundant ration which consisted of 16.94 % for first lot, and decreased from 32.7 to 13.8 % in the fourth). The supplementary food was given in constant quantities in the three first groups and weekly decreasing quantities in the other three. The best results were obtained with large quantities of tankage in definite proportion to the maize. The best results with small quantities of tankage were obtained when it was fed in larger quantities at first and gradually decreased. The medium rations gave better results than the small and abundant ones.

The object of the 5th. experiment which lasted 16 weeks was to compare the values of tankage, soybean meal and linseed oil meal as supplements to maize (the first two in varying quantities). Eight lots of 5 pigs each were used the average weight of the pigs being 144.0 lb. Those fed a ration containing 10 % of tankage showed an average gain of 36.2 % and consumed 10.4 % less food than the group fed maize only. Better results were obtained with 10 % of tankage than with 5 or 20 %. When the supplementary ration was increased a larger quantity was required to replace 1 unit of maize. On the basis of equal quantities of protein, soybean meal and linseed oil meal gave better results than tankage, considering their content in nitrogen-free substances. Economical gains were most constant with tankage. At the outset soybeans gave gains with the smallest consumption of food, but, during the latter part of the experiment, it was surpassed by linseed oil meal.

In the 6th. experiment a lot of 6 pigs of an average weight of 71.75 lb. was fed during 14 weeks on maize and tankage in self-feeders, so that

the animals could eat as much of each food as they liked. The average daily increase in weight was 1.5 lb. per head, with a consumption of 3.89 lb. per lb. gain. The amount of tankage consumed increased during the first three weeks, rising from 14.6 to 19 % of the ration, and then decreased to about 5.6 % during the last eight weeks of the experiment. The average amount consumed throughout the experiment was 12.4 parts of maize to 1 part of tankage.

In the 7th experiment, which lasted 10 weeks, three tests were made with skim milk as a supplement to maize. When maize and skim milk were fed *ad lib.* the pigs took less milk as they grew older. More skim milk in the ration lessened its value as a substitute for maize. As compared with tankage as a supplement to maize it cost less per lb. of gain, although there was a smaller difference during the second half of the experimental period than during the first.

Five lots of 5 pigs, of an average weight of 79 lb., were used during the 15 weeks of the 8th experiment in which maize and skim milk, both separate and mixed, and maize and tankage, were compared. Maize alone and skim milk alone gave bad results as compared with those obtained with the two foods mixed. Pigs fed skim milk only made fairly good gains in live weight, but did not fatten. On an average they consumed 36.6 lb. of skim milk each daily and gained slightly more than 1 lb. daily. In a ration of skim milk and maize in equal parts, compared with maize alone 3.37 lb. of the first replaced 1.37 lb. of the second. When skim milk was used as a supplement to maize a smaller quantity of nutritive element was required per lb. of gain than when the supplement was composed of tankage, but the gain was more rapid with tankage.

The 9th experiment aimed at obtaining new data on the use of different proportions of maize and skim milk for fattening pigs. Seven lots of 5 pigs were used, five of which received maize and skim milk in different proportions, one maize only and one maize and tankage. The average initial weight of the pigs was 43.6 lb. and the experiment lasted 15 weeks. The lot fed maize only did very badly; the daily average gain was 0.35 lb. per head, with a consumption of 6.85 lb. per lb. gain. The lot receiving maize and tankage (in the ratio of 9 : 1) made smaller gains than any lot receiving maize and skim milk. With maize and skim milk in equal parts or maize and tankage in the ratio of 9 : 1 a smaller amount of dry matter was required to produce 1 lb. of gain with skim milk than with tankage. When the ratio of skim milk to maize exceeded 50 % of the ration its substitution value decreased. When the pigs received maize and skim milk *ad lib.* the proportion of skim milk to maize increased during the first five weeks, then gradually decreased from the 7th to the 16th. On an average the pigs ate 22.2 lb. of skim milk per day, or 6.4 lb. per lb. of maize. They gained weight more rapidly than those pigs receiving less milk, and the quantity of total food elements required per unit of gain was smaller.

CONCLUSIONS — Further experiments are necessary to determine the best proportion of tankage to be fed to pigs, but it seems that, if 10 % is given, there is no advantage in giving a larger quantity at the beginning

of the fattening period than at the end, when, however, only 5 % of tankage is given, a larger quantity should be supplied at the outset. Skim milk is a more profitable maize supplement than tankage, especially for young pigs. No definite maize supplement seems the best, nor does there appear to be any optimum proportion in which to administer it, the choice of both depends the age of the pig, the market price of fat-hogs, the price of maize, and the availability of the supplements

231 - **The Artificial Lighting of Hen Houses.** — ELFORD, F. C., in *The Agricultural Gazette of Canada* Vol. V, No. 11 pp 1043-1048 + 1 Fig. Ottawa, November, 1918

To solve the much-discussed problem of the usefulness or harmfulness of artificial light in hen houses the Poultry Division of the Experiment Station of Ottawa carried out experiments during the winters 1916-17 and 1917-18 with the Barred Rock and Leghorn breeds. Electric lamps were lit in the hen houses from 6 a. m. till daylight, and from dusk till 9 p. m. In the houses of the control hens no light was lit.

The experimental groups produced most eggs in December and January, the control groups in March-April for the Leghorn breed, and in January-February for the Barred Rock. The advantage of lighting depends, therefore, on the object in view. If it be desired to have eggs at the beginning of winter to sell fresh at a high price, lighting is an advantage, if eggs for hatching are desired it is a disadvantage. The difference in the total number of eggs laid between the experimental and the control groups was small (in all 2 470 and 2 242 eggs respectively from November to April by 40 hens). Experiments on the effect of lighting on the health of the hens are in progress

232 - **Feeding Fowls with Wheat Treated with Copper Mixture; Experiments in New South Wales, Australia.** — *The Agricultural Gazette of New South Wales* Vol. XXIX, Pt. 9 p. 667 Sydney, September, 1918

As farmers do not always sow all their sulphate-treated seed it is of interest to know whether it may be fed safely to hens. With this end in view the Agricultural Department of New South Wales made a series of experiments at Hawkes Agricultural College. Twelve Rhode Island Red hens were divided into three lots, each receiving their normal food in the morning. In the evening Lot 1 was given wheat which had first been soaked in a 1.5 % copper sulphate solution, then in lime (according to the formula proposed by the Department of Agriculture), Lot 2 wheat soaked in 1.5 % copper sulphate solution only, and Lot 3 a mixture of $\frac{1}{3}$ wheat grain and $\frac{1}{3}$ maize.

RESULTS. — 1) The treated grain was always eaten immediately by Lots 1 and 2; 2) the three lots ate equal amounts of grain daily, 3) from June 17, 1917, to February 28, 1918, the three lots produced 997, 976, and 939 eggs respectively; 4) the eggs were normal in size, shape and appearance, 5) the health of the hens was always good, no change was observed in the excreta as a result of the continued use of copper sulphate.

A post mortem examination was made of some of the hens of the first

two lots. Externally there were no signs of any injurious effect exercised by the sulphate-treated grain, but in a few cases there was a marked effect on the liver and a slight effect on the intestines. This shows that the continued use of copper sulphate, even in small quantities, may have bad results; moreover the action of copper sulphate is known to be cumulative.

CONCLUSIONS. — When it is essential to avoid all waste, sulphate-treated grain may be fed to hens with danger on condition that they form small part of the ration only and are not used for more than a few months.

233 - **The Rouen Duck; its Value for Crossing Purposes.** — FAUC LON, X, in *L'Acclimation, Journal des Elevateurs*, December 8, pp. 388-390 Paris, 1918

The Rouen duck is a useful breed, prolific, easy to raise, and much appreciated everywhere. It resembles exactly its ancestor, the wild duck, except that, under the influence of domesticity and breeding, it has increased in size and weight. The Rouen duck improved by selection may weigh as much as 9.9 lb., whereas the wild duck barely weighs 3.3 lb. The laying capacity of the Rouen duck is also five times that of the wild duck. Rouen duck breeding has always been an excellent investment; the principal markets are Duclair, Gournay et Dieppe.

The Duclair duck is a local variety of the Rouen duck, obtained and selected particularly at Duclair (about 12 miles from Rouen). The Duclair duck, massive in form with a wing stretch of 3.4 ft., dark plumage and flesh, is prolific and matures early. Its flesh is excellent but has a more marked flavour than that of the Rouen duck, this phenomenon is always found in breeds in which black predominates (Cayuga, Labrador), and is attributed to "melanism", i. e., the presence of a large quantity of pigment in the blood, the opposite phenomenon, "albinism" (white plumage and flesh) produces the contrary effect. The Rouen duck has a most favourable influence on other breeds which need improving in view of production. It is largely used for crossing purposes in other districts; for example, in the south-west, crossing the Barbary drake with the Rouen duck has given the so-called "mulard" or "mulet" duck, heavy large, unprolific, but with fine, delicate flesh, strong tendency to fatten, and very large liver, used in the "foie gras" industry.

Crossing the Rouen duck with other breeds, such as the Pekin and Aylesbury, also gives excellent results — fine flesh, rapid growth, early maturity, large size, and strength. Crossing the Aylesbury with the Duclair variety gives the same results but yet stronger progeny. The production of the Rouen duck should be developed, both because of the profit to be derived from it and its usefulness in the present food crisis.

234 - **Silkworm Breeding in Morocco.** — LEVRAT D, in *Rapport sur la Mission Sericole au Maroc (Octobre 1916)*, *Chambre de Commerce de Lyon, Laboratoire d'études de la soie de la condition publique des soies de Lyon* pp. 22 + 1 map + 12 Photographs, Lyons, 1918

Since 1914 the Administration of the Protectorate has taken steps to revive silkworm breeding by making several new mulberry tree plantations

and organising silkworm breeding in the Fez district. The aim of the first year was to gain experience for the following one; 880 lb. of cocoons were obtained. In the second year 3 300 lb. of good quality cocoons were obtained. In 1916 (the year in which the author made his investigation journey and report), as a result of pebrine and flacherie, 16 ounces of eggs divided among 120 breeders, gave only 1793 lb. of cocoons. Flacherie may be produced accidentally by unfavourable climatic conditions or lack of hygienic care during breeding. Pebrine, on the contrary, may easily be avoided by the use of eggs guaranteed to be healthy. The cocoons obtained in 1916 were used in the spinning bowls set up in the Fez fair and proved very instructive to the natives who also received lessons in silkworm breeding and the silk industry by means of cinematograph films.

The mulberry trees are scattered about the gardens. The greatest development of silkworm breeding in Morocco was from the 10th to the 13th centuries, but it disappeared under French and Italian competition. The Moroccan silk industry could not resist competition because it retained the primitive methods of silkworm breeding, and it died out completely in the 19th century as a result of pebrine. The old mulberry trees are all that remain of the dead industry. Nevertheless the silk industry and native spinning survived the disappearance of the breeding industry and, at the present time, over 400 spinning looms work in the Fez Medina and in all the other towns which formerly were also centres of silk production.

At the present day this industry is dependent on foreign countries, especially France and Italy, for the 4 400 000 lb. of silk it requires. Details are given of the imports from 1910 to 1915 showing, among other things, the preponderant importance of French products in these imports.

A description is given of the methods used in the Moroccan industry. They are mostly very primitive, but the workmen are skilful and often make very beautiful materials. In the author's opinion it is not desirable in the interest of the Moroccan art itself, to replace the hand loom by the mechanical loom, as it is too early for such a change. The French object should be the development of silkworm breeding. From this point of view everything remains to be done, from the planting of mulberries to the professional instruction of the natives. To this end the support of the public bodies is indispensable.

First of all the most favourable district for silkworm breeding must be chosen. The pure air and moderate heat necessary can be found only in the mountains. The most suitable mountains seem to be those stretching from the south of Fez to the first heights of the Central Atlas, with Seffrou as centre. The eggs could be kept in the neighbouring high mountains during winter. Nurseries of the different varieties of mulberry should be formed, and the trees planted, not by the roadside where the dust continually settles on the leaves, but in the fields, in well-spaced rows between which other crops may be grown. A silkworm breeding station must be established which will produce healthy eggs, distribute them among the natives, and supervise the breeding of the silkworms. The indispensable technical instruction must be given to the natives. For some time the har-

vest should be sold locally and, after the chrysalids have been smothered, exported to Marseilles.

To sum up, the author wishes to preserve the artistic, domestic, and pastoral character of the Moroccan industry, and to give an energetic start to silkworm breeding itself.

235 - **An Experimental Study of Carrying and Cart-drawing by Dogs.** — HACKETT-BOULET, J., in the *Revue Scientifique*, Year CLVI, No 16, pp 492-496 Paris, 1918

The author made an experimental study of carrying and cart-drawing by dogs, and collected many data on this subject which have enabled him to estimate the extent to which dogs may humanely and practically be utilised for these purposes

1) **THE RESPIRATORY FUNCTIONS OF THE DOG AND ITS EQUIPMENT.** — According to most workers who have studied the subject, the most logical way to harness a dog is to harness it as far as possible like a horse. This is the practice which has always been followed by the Belgians, past masters in the rational utilisation of dogs for drawing carts. In view of the differences between the physical resistance and anatomy of dogs and horses it is, however, necessary to modify somewhat the system of harnessing for horses (collar and chest strap). The horse-collar is ill-adapted to the dog and soon hurts it because the dog has not the marked projection towards the lower end (excellent support) of the horse, and its almost horizontal neck causes the collar to press on the wind-pipe. The chest strap interferes with the respiration of the dog as, when breathing in, the rise of the lateral walls of the chest is prevented by the tension of the strap during motion. The ribs of the dog must, therefore, be protected, and various contrivances have been devised to this purpose — a chest strap with a metal frame, padded inside, a belt with a small hoop placed across the dog's shoulders to separate the reins, a belt strapped to each end of a metal hoop placed over the dog and very similar to that of a Russian "troika".

2) **THE MOVEMENT OF THE DOG, THE SHAFTS AND POLE.** — While walking the movements of the dog are what DARWIN has called "flexuous"; to this "undulating" tendency is added that of "crossing" (i. e. the foot-prints of the back limbs are not on the same lines as that of the fore ones), so that the parallel lines of the shafts hinder the dog very much. This may be remedied by tying the dog, under the cart, to the axle-tree, as is done in Belgium and Germany, but this has the disadvantage of preventing the animal from properly guiding the cart. Another, more suitable, arrangement is that of the jointed pole, a steel tube or wooden pole passing over the dog's back and attached by the end to the upper part of the rigid chest strap described above; the double joint allows the chest-strap, and consequently, the dog's body, to move vertically and horizontally. This arrangement removes all the disadvantages mentioned and gives the animal the greatest possible freedom of movement. Dogs so harnessed do excellent work.

3) **THE WITHERS AND FOOT OF THE DOG.** — The shoulder resistance is sufficient to allow drawing, i. e., the withers are strong enough to pull a carriage or bear a pack saddle. Numerous tests have shown that two dogs

with pack saddles can carry a man weighing 165 lb. several hundred yards (maximum effort). The joints of the dog, a digitigrade runner, move almost exclusively in lines parallel to the direction in which it is going, so that sprains are very rare, indeed practically never occur. The elastic balls under the foot resist, in dogs covering long distances, even on pebbles. To harden the underneath of the paw, an ointment of soot and tallow is excellent.

4) TRAINING, GUIDING WORK. — Advice is given on the training and guiding of dogs. They may be lead by an ordinary collar with rings on either side to which the reins are fixed. Guiding with a stick only also gives excellent results. The minimum height of a draught dog must be 1.8 ft. The amount of work a dog can do depends more on its energy than its size as it pulls more especially by gathering together and then stretching its limbs. Without considering the obvious exaggerations on the amount of work a dog can do, it may be said that an average animal can pull at a rate of 3.6 miles an hour, including stops, a useful load of 130 lb. on a cart of the same weight over a distance of from 25 to 36 miles if necessary. In this case the dog itself might weigh only 88 to 110 lb. Very good work may be done with 2 or 3 dogs harnessed to one cart; in this case the rule of the destruction of strength when animals work together is observed. One dog alone gives a work of 110 lb., two dogs harnessed together a work of 215 lb., and three dogs together, a work of 264 lb. A rest of 2 to 4 minutes every half hour is sufficient but indispensable. The minimum ration for a dog working several hours a day is 450 gm. of meat and 1 kg. of bread.

5) PACK SADDLE DOGS. — A rational pack-saddle system is described. The saddle, on which the pack is fixed is well strapped on. To prevent over-tight strapping, thus crushing the animal's sides, a light aluminium frame is advisable, arranged in a similar way to the chest-band described, and being held in place, without moving, by its shape. Although some mastiffs and other dogs can carry as much as 44 lb., the average weight allowing rapid movement is 22 to 33 lb. A double pack saddle is also used. The author believes the dog will be used increasingly as a draught and pack animal and that its value as such is not to be despised.

236 — **The Sheep-killing Dog in the United States.** — WILSON, J F, in the *U S Department of Agriculture, Farmers' Bulletin* No. 935 Washington, February, 1915

The total annual loss of sheep killed by dogs on the farms of the 36 western states is 107 760 head, or 1 % of the total number of sheep in these states, thus decreasing appreciably the possible profits and hindering the full development of sheep rearing.

The replies received by the Department of Agriculture from its crop correspondents show that the present number of sheep in the states under consideration could be increased by 150 % without decreasing the stock of other animals. These replies also show that sheep-breeding is considered very profitable, but that the dogs are the chief obstacle to its development. To remedy this the author recommends a higher tax on dogs so as to reduce the number of superfluous ones, and the adoption of severer

laws against an excessive number of dogs. The outline of such a law is given; it aims at taxing dogs, identifying those for which licenses have been paid, the control of sheep-killing dogs, and making the shepherds financially responsible for such losses.

A description is given of a metal fence suitable for enclosing sheep-runs through which dogs cannot pass. This fencing was tested by the U. S. Forest Service and found impenetrable by sheep dogs and coyotes.

An appendice contains a summary of the laws against dogs in the different states and, in full, those of Pennsylvania and West Virginia, as examples of modern laws affording efficient protection to owners of flocks.

FARM ENGINEERING.

237 - **Tractor Schools Organised by the "J. I. Case Threshing Machine Co."**, in the U. S. A. — *Farm Implement News*, Vol XXXIX No 44 p 15 Chicago, October 31, 1918.

The "J. I. Case T. M. Co", of Racine (Wisconsin), has announced its seventh annual tractor course. The courses, absolutely free to all farmers and operators, are conducted in all parts of the United States and Canada and last a week. The work is divided into 3 branches: — 1) lecture and introduction, 2) repair and shop work; 3) tractor operation and work on tractors.

SYLLABUS OF THE COURSE — *Motor*: its principle, operation and adjustments; general troubles; loss of power; how to grind and reset valves, fitting pistons and rings; adjusting bearings, timing of valves and ignition; lubricating.

Ignition systems: the different types and their principle; how to detect and remedy ignition trouble, adjustment and care of ignition system.

Fuels and carburettor: fuels, their comparison and use; carburettor trouble, adjustment of carburettor; kerosene and its use.

Lubrication and lubricants: oils and greases and their proper use; oiling systems, adjustment and care.

Cooling system: cooling system explained, its proper use and care.

Tractor chassis: trucks and frame; transmission and gears; adjustment, overhauling and general care of tractor

Tractor operation: starting motor and handling tractor; general operative subjects.

Tractor work: use of tractors for various operations; traction work; belt work; proper use of tractor.

Implements: hitching of ploughs and farm implements; draft of various implements, care and operation of farm implements.

238 - **Power Farming Tests Organised by the "Chambre Syndicale des Constructeurs de Machines Agricoles de France"**, at La Verrière. — I. VAN ZULPELE, in the *Bulletin Mensuel de la Chambre Syndicale des Constructeurs de Machines Agricoles*, No 7, pp 378-380 Paris, Octob 1, 1918 — II. RINGELMANN, M, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Ycai CXVII, Vol CXXX, No 5, pp 291-295 + 3 Figs. Paris, 5th 10th 1st October, 1918 — III. LEXELLER, P, in the *Bulletin de la Société des Agriculteurs de France*, *Revue agricole mensuelle*, pp 231-235 + 1 Table Paris, October 1918

I — M. VAN ZULPELE, in reporting on the trials organised by the

"Chambre Syndicale des Constructeurs de Machines Agricoles de France" at La Verrière (Seine-et-Oise, France), says that he has not observed anything that might constitute a striking novelty in the motorculture industry.

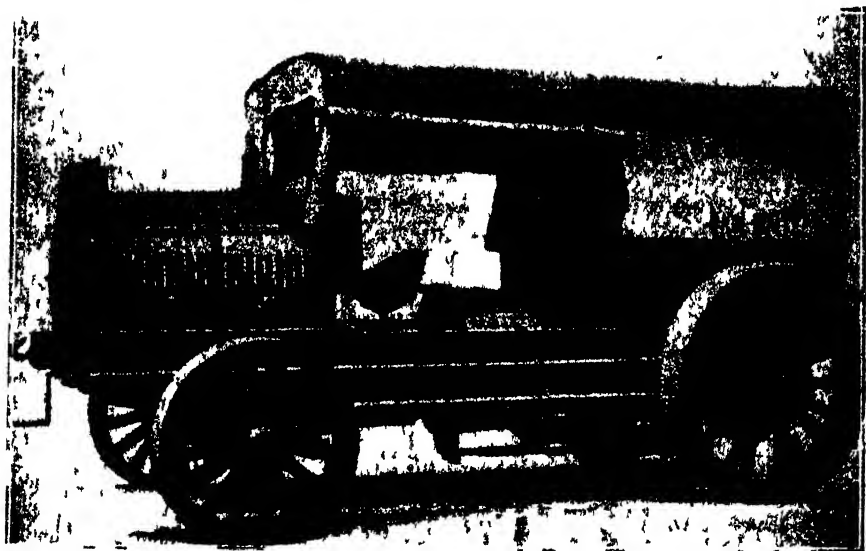
The following machines (1) were admitted to the trials: — 1) **TOURAND-LATIL** motor-plough [30 H.P.; weight 6 380 lb.; plough, 3-5 furrows] — 2) **CASE** tractor [a] 18 H.P.; weight, 4 900 lb.; 3-furrow plough — b) 25 H.P.; weight, 10 780 lb.; 4-furrow plough] — 3) light **DE MESMAY** tractor [15 H.P., weight, 4 180 lb.; plough] — 4) **Mogul** tractor [20 H.P.; weight, 6 490 lb.; 3-furrow plough] — 5) **Titan** tractor [20 H.P.; weight, 6 490 lb.; 3-furrow plough] — 6) **Beemann** tractor [4 H.P.; weight, 627 lb.; various implements] — 7) **de DION-BOUTON** windlass ploughs [a] 40-50 H.P.; weight, 14 740 lb.; balance plough; b) 25-35 H.P.; weight, 1 760 lb.; cultivator] — 9) **MISTRAL** tractor [20 H.P.; weight not given; plough] — 10) **Happy-Farmer** tractor [16 H.P.; weight, 4 730 lb.; 2-furrow plough] — 11) **Ar-Denn** tractor [by **H. BAUCNET**, at Sens, Yonne, France; 45 H.P.; weight 7 700 lb.; 3 furrow plough] — 12) **SANDUSKY** tractor [25 H.P.; weight, 4 070 lb.; plough] — 13) **FILTZ** haulage-tractor [32 H.P.; weight, 4 180 lb.; balance plough] — 14) "**Motoculteur**" [of the "**Motoculture Française**" Co., of Paris; type A; 30 H.P.; weight, 4 400 lb., with rotary apparatus or digger and gang] — 15) **DOISY** windlass-tractor [25 H.P.; weight, 7 040 lb.; 5-furrow turnurest plough] — 16) **SEUNDESOU** Universal tractor [25 H.P.; weight, 6 564 lb.; 3-furrow plough]. (Beides these tractors **M. P. LÉCLERC** also mentions the "**Aurore**" tractor of **NEUBERG & SONS**, 3, Rue de la Boétie, Paris; 14 H.P.; weight, 3 960 lb.; 2-furrow plough). The Universal, **DE MESMAY**, **FILTZ** haulage-tractor, **de Dion-Bouton** ploughing windlass, **DOISY** windlass tractor, **TOURAND-LATIL** motor plough compare favourably with those machines not made in France. They are carefully and strongly made and work smoothly. The "**Motoculteur**" does a new kind of work, reducing the arable layer completely to a uniform fine tilth. The working of the tractor, that took part generally left a good impression. Those tractors that the author saw working all pulled plough, brabant, gang and balance ploughs of wellknown types, some in stubble, others in fields that had been ploughed shallowly; others worked in clover fields or artificial meadows.

II. — **M. RINGELMANN** describes the **DE DION-BOUTON** ploughing windlass as follows: — 2 windlasses, as in the big steam machines, haul a balance plough with a cable; each motor windlass is driven by a 4 cylinder motor, of 125 mm. bore and 150 mm. stroke, developing 50 H. P. at 1 000 to 1 200 revolutions. The front wheels are 1 metre in diameter with a tyre 20 cm. broad; the rear wheels are 1.40 metres in diameter with a tyre 25 cm. broad. The cable, winding on the windlass whose horizontal axis is perpendicular to the shaft, has a speed of 3 700 to 4 500 metres

(1) The notes in square brackets are taken from the table drawn up by **M. P. LÉCLERC**. (Ed.)

per hour ; the average pull is 3 200 kg. The cable is 500 metres long and 15 mm. in diameter ; its breaking strain point is 12 000 kg.

Each windlass weighs 6 000 kg. On the road it runs at 3 000 and 7 000 metres per hour reducing to 1 400 metres in the field. The minimum turning radius is 7 metres. A de DION-BOUTON windlass is shown in the appended figure. The 35 H P windlass is built on the same model as the 50 H P. one — 4-cylinder engine, of 100 mm. bore and 140 mm. stroke ; 1 000 to 1 200 revolutions per minute ; front wheels, 90 cm. in diameter with 20 cm. tyres ; rear wheels, 1 20 metres in diameter with 20 cm. tyres ; cable : diameter, 13 mm. ; length, 400 metres ; resistance to breaking, 9 000 kg ; speed, 3 700 to 4 500 metres per hour ; average pull, 2 000 kg.



DE DION BOUTON WINDLASS

On the road the speed varies from 3 000 to 5 000 metres per hour ; in the field, by changing the chain pinion, the speed can be reduced to 2 000 or 3 000 metres per hour. The minimum turning radius is 7 metres.

The other machines have been described previously by the author and nearly all have been noticed in the *Bulletin*.

III — According to M. P. LÉCLERC, the trials at La Verrière mark an important stage in the history of power farming and the progress made since the trials at Grigny (France), in 1917, is considerable. Besides foreign made machines, a large number of machines made by the big French firms were shown at La Verrière. The ground at La Verrière was suited to the working of the machines : fairly level, of perfectly even character without any stones or obstacles, sufficiently damp to work easily, and not

so damp as to hinder the progress of the machines ; there were long strips of land so that frequent turning was avoided.

While reserving judgment on the principle of the rotary apparatuses, owing to the lack of sufficient experience, it may be said that, on the whole, the machines shown at La Verrière will probably be of good service to farmers.

All the machines seen at la Verrière had explosion motors, mostly vertical and multi-cylindere and running at from 1 000 to 1 200 revolutions. Save a very few exceptions, the H.P. of the motors varied from 20 to 40, and the weights were under 6 600 lb (save for the windlasses).

The use of suspension springs is becoming more and more frequent, there is a tendency to abandon 3-wheeled for 4-wheeled machines, with triangular suspension.

Although at first sight it seems easy to attach an implement to a tractor, it is not so in fact and regarding this the author points out the error in those attachment devices that form a rigid whole of both tractor and implement as well as those that leave too little space between them, owing to which the tractor tends to steer badly.

The difficulty is in not only knowing the work to be carried out but also in arranging the machines in such a way that the work can be done under the varying conditions of soil and weather that may be met with. For the author, there are not 2 well-defined problems that are placed together, one mechanical and the other agricultural, but simply a *single problem* of very complex "agro-mechanics" that constantly varies according to the weather, the nature and configuration of the soil, etc., a problem capable of several solutions, each of which is only of value between certain fixed limits.

The appreciation of the arrangements as a whole and in detail that should be adopted in order to correspond to fixed conditions of use that vary for the same farm, the same field, is particularly difficult, for it is influenced *simultaneously* by agricultural and mechanical factors. The farmer indicates the agricultural factors, the mechanic indicates the mechanical factors, but the two must be embodied in one person so as to take the two categories of factors simultaneously into account.

Makers who are for the first time turning their attention to power farming must consider this situation carefully and not imagine that it suffices to produce a machine well conceived from the mechanical standpoint in order to have a rapid sale of large numbers.

The field of action in power farming is very vast ; everywhere hand-labour has to be replaced by power farming machines with the slightest possible delay.

239 - Traction with "Poor Gas". — DE MONGOLFIER, I., in *La Technique Moderne*, Year X, No 9, pp. 424-426 + 4 Figs. Paris, September, 1918.

To remedy the lack of carburants for road haulage, lighting gas was used in England (1), stored in flexible balloons or compressed in rigid tubes. In Holland (2) hydrogen was used and, in Switzerland, synthetic

(1) See R., June, 1918, No. 680 — (2) See R., May, 1918, No. 565 (Ed.).

alcohol obtained from calcium carbide (which is cheaper than alcohol obtained by fermentation but is still a costly carburant). At present there is a shortage of carburants like paraffin and the heavy oils, and so gas offers the best possibility of success for hauling heavy loads. For passenger cars, petrol will long remain the most suitable carburant. The application of "poor gas" to the automobile consists in adding a light and small gas producer to the frame so as to replace the balloon or reservoir of compressed lighting gas; only the same engine cannot be used unless important changes are made in it. "Poor gas" engines require a special compression and distribution, which are difficulties that are compensated by considerable economy in consumption as shown by road trials carried out by a motor lorry running on poor gas (economy of 80 % *ad valorem* in comparison with petrol engines).

To adapt poor gas to motor traction, the engine must be neither too heavy, nor too bulky. To attain this, small engines have been built weighing only 450 kg., running at about 1 000 revolutions, of 135 mm. bore and 170 mm. stroke, which, with 4 cylinders, develop about 40 H.P.

The compression is 10 or 12 kg., instead of the 4 or 4.5 kg. in petrol engines. The chief difficulty is to find a light motor, not bulky, and producing a clean gas after passing it through a scrubber and washer. Those poor gas lorries that are now working have a gas producer fed exclusively with wood charcoal; the anthracite gas producers did not give such good results, as the gas produced contained more tar and other impurities than that obtained with wood and wood charcoal producers. The thermal yield of the poor-gas engines is double that of the steam engine. Poor-gas offers uncontested advantages over steam, petrol and paraffin for powers ranging between 20 to 100 H.P. For power farming, poor-gas traction would give an enormous economy. The author's study contains several figures, including one of a poor-gas motor lorry and one of a poor-gas electro-generator plant of 40 H.P.

240 - **The Estimation of the Work of a Power Farming Machine.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year LXVII, Vol CXXX No 5, pp 281-283. Paris, September-October, 1918.

The author gives an approximate solution of the following problem : — When the test of a power-farming machine lasts 10 to 30 minutes, how can the work that can be carried out under practical conditions be estimated, only considering the measure relating to the speed during the work ?

Let l be the width worked by the machine in metres, c the distance travelled in metres per hour while the machine is working (ploughing, etc.).

If there were no time lost the surface S worked per hour would be, in sq. metres, equal to lc . But, given that about the same time is lost in turning, the product lc should be multiplied by a first reduction coefficient m varying from 0.86 to 0.77 for an average furrow length of 150 metres; this coefficient diminishes with the speed of progression. The actual work per hour is only 50 minutes, owing to various stoppages in practice, lubricating, inspecting the machinery, which requires a second re-

duction coefficient of 0.83, so that, if K be the final coefficient, the following table will be obtained, K varying with the speed forward during the work

Speed forward (in metres) during work		Coefficients	
per second	per hour		
0.80	2 880	0.86	0.71
0.90	3 240	0.85	0.70
1.00	3 600	0.83	0.69
1.10	3 960	0.82	0.58
1.20	4 320	0.81	0.67
1.30	4 680	0.79	0.66
1.40	5 040	0.78	0.65
1.50	5 400	0.77	0.64

To sum up, the surface S on which one can reckon in current practice is given by the formula $S = Kl c$, where K is the coefficient, shown in the above table, corresponding to the distance c travelled per hour in metres while the machine is working during the test. Thus, in a trial, it was found that, with a width l of 0.90 metres, the machine moves along the furrow at a speed c of 3 240 metres per hour, and the cultivated surface S on which one can reckon will be $S = 0.70 \times 0.90 \times 3\,240 = 2\,041.2$ sq. metres

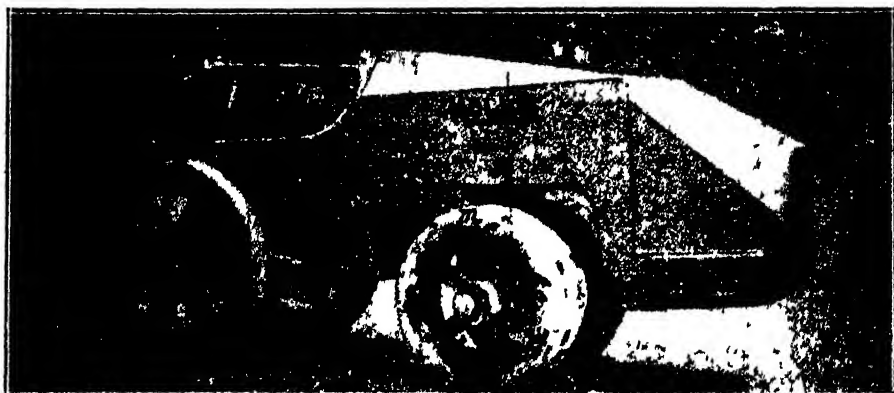
The previous table of the coefficients K can only be used for approximate calculation. If more accuracy is desired, a special calculation must be made for each case under consideration, while taking into account the furrow length and the average time required for turning.

In the case of vines or hoeing drilled crops, the uncultivated portions and the time required for turning must be taken into account. The formula $S = Kl c$ may be used on adding to l the corresponding portion a of the uncultivated portion, that is, $l + a$ if the space between the drills is worked in a single turn, or, again $l + \frac{a}{2}$ if the space between the drills requires two turns to cultivate it. This is equivalent to substituting for l of the formula the width E between the vines (in metres), if the space between the lines is worked in a single turn, or $\frac{1}{2}$ and $\frac{1}{2}$ if it is cultivated in 2 or 3 turns respectively.

241 - **The Hollis Tractor.** — RINGELMANN, M in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol CXXX, No 5, pp. 286 288 + 2 figs. Paris, September-October, 1918

Description of the HOLLIS tractor made by the HOLLIS Co., of Pittsburgh, Pennsylvania, U. S. A., and shown in the appended figure. The 4-cylinder motor, developing 25 H. P., is placed in front under the bonnet a , and the cooling system has a capacity of 113 litres. The 2 driving wheels are in front and can turn in a horizontal plane around the vertical axis y .

These 2 wheels, of about 68 cm. in diameter and 20 cm. in tyre width, are very close to one another, which has enabled the differential to be eliminated; the distance from hub to hub is 55 cm. All the gears run in oil baths in gear boxes. The 3 speeds, forward and reverse, are of 2 800, 4 000 and 11 200 metres per hour. The rear, weight-carrying wheels *b* are about 85 cm. in diameter; the wheel base is 1 85 metres; the chassis is only 60



HOLLIS tractor

cm wide The outside measurements are -- length, 3 45 metres; distance from front to the axis *y*, about 1 20 metres, total weight, 1 135 kg.

On account of the arrangement of the driving wheels, whose axle can turn horizontally through 2 right angles, the machine can move backwards or forwards, while it can turn in a radius of 1 35 metres. This tractor is mounted on springs, with a view to hauling on the road

- 242 - **The Mechanical Cultivation of Vines with a 10-20 H. P. Mogul Tractor.** — I CAILLAULT, A, in *Le Progrès Agricole et Viticole*, Year XXXV, Nos 36 and 31, pp 607-611, 110 111 + 4 Figs Montpellier, June 30 and August 4, 1908 — II RINGELMANN, M, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol CXXX No 5 pp 275 278 + 3 Figs Paris September October, 1918

M. CAILLAULT, a vine-grower of Champigny-le-Sec (Vienne, France) has bought a 10-20 H. P. Mogul tractor for use with his vines and cereal crops. He found that the tractor, with 2 men and a 3-furrow plough, did as much work as 5 teams and 5 drivers in the same time.

The vineyard is on a slightly sloping hillside (60 cm. per 100 metres), the lines are 2 metres apart and 250 metres long, with a road at each end. The vines, pruned on the double Guyot method are trained on two iron wires, one 30 cm, the other 60 cm, above the ground, supported by wooden posts over an area of 1 hectare and on iron posts over 5 hectares; one hectare has neither wire nor posts. The vines, from 5 to 25 years old, have some branches that droop irregularly on the two sides. The Mogul tractor is 1.43 metres broad between the external rim of one wheel to the other, leav-

ing a play of 28 cm. between each wheel and the axis of the line of the plants, which is sufficient; a momentary deviation of 10 to 15 cm. of the front wheels of the tractor only causes the driving wheels to move $\frac{1}{2}$ cm. out of line, without affecting the plough.

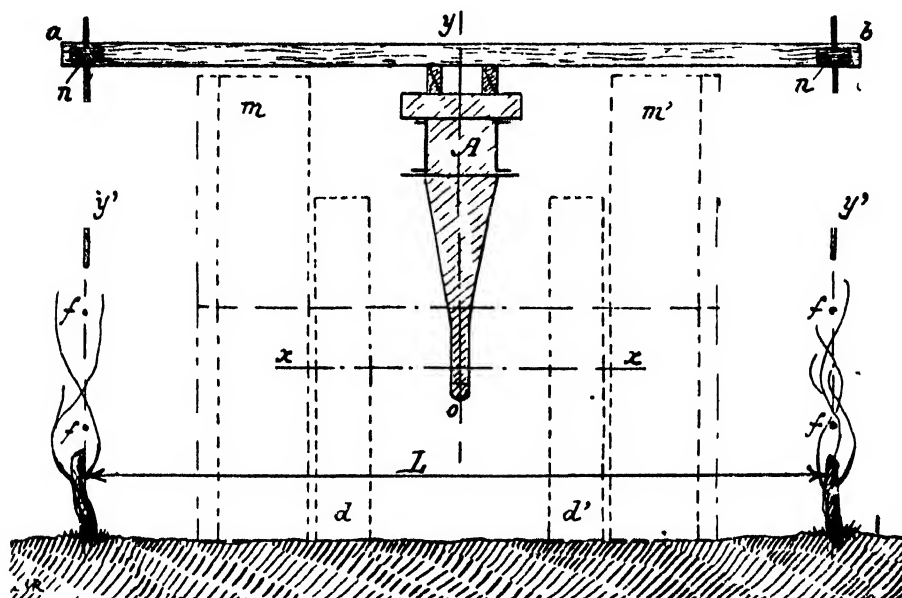


Fig 1 -- Mounting of the CAILLAULT guide on the 20 H P Mogul tractor for working among vines (front view)

M. CAILLAULT has furnished the tractor with a guide so as to keep it in a straight line. This guide is fixed on the front *A* (see Fig. 1) of the tractor and parallel to the axle *x* of the steering wheels *d*, *d'*; the driving wheels project at *m* and *m'*. The guide consists in a plank *ab*, 2.10 metres long and with a section of 5×3 cm.; its centre coincides with the axis *oy* of the tractor; at *y'* and *y''*, at the distance *L* from the vines (2 metres), whose wires are shown at *f*, 2 willow sticks *y'* and *y''*, the bottom of which are kept 5 cm. above the posts, are fixed by 2 bolted plates of wood. During the work, the mechanic only watches one of the sticks, which should be above the iron wire or the line of plants. For cultivating vines, M. CAILLAULT has made a vineyard plough, the principle of which is shown in Fig. 2. The ploughs *a-b-c-d-e* are mounted on a single wooden frame; the front plough *c* only has the share, the mould board having been removed; the ploughs *a-b* and *d-e* turn the soil on the side of the axis *fy* of the space between the vines; each plough, whose share works a width of 28 cm., is preceded by a circular coulter, shown diagrammatically at *n* and regulated to a depth of 7 or 8 cm. The width worked is 1.40 metres.

and WIGMORE, 3 Rue Taitbout, Paris. The Railway Company, which offers a prize of 1000 frs. for the best apparatus for the mechanical cultivation of vines, proposed to organise a series of demonstrations during the winter of 1918 in all the vine-growing districts in its radius, so that the growers could judge of the results this apparatus gives. The experiments in each district were to last 2 days, the second only being open to the public.

The "Viticulteur", which is shown in the figure, is a motor push-plough which may be used among weeded crops. The two large front wheels, 1.10 metres in diameter and 0.14 metres in tyre width, are worked by a 10 H. P. one-cylinder motor (90 mm. bore, 150 mm. stroke). The motor is on a frame, between the front and back wheels, which are 0.45 metres in diameter. Below the radiator is the change speed gear (average speed 3.815 yds. per hour); and, behind, the petrol tank. The frame, which will take a case fitted with various parts, ends in two shafts, guided by the worker. The machine is 2.5 ft. broad, 5.6 ft. long, has a total height of 3.9 ft. and weighs 1100 lb. It is said to work satisfactorily in the vines, spaced 4.5 ft. apart, of the Haut-Brion estate, near Bordeaux.

241 - **Mould-board Ploughs and Disk Ploughs.** — RINGELMANN M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol CXXX, No 5, pp. 296 297 Paris, September October, 1918

The following notes on the use of mould-board ploughs and disk ploughs in the soils known as "boulbènes" were presented by M. DAVASSE to the "Société d'Agriculture de la Haute-Garonne", France, "Boulbènes" ("boubées" or "bolvènes") are quaternary deposits almost entirely lacking in lime, i. e. clay which coagulates little or not at all (the "terreforts" of the neighbouring table lands always contain a large quantity of lime-stone, and have not the same effect on machines and cultivation apparatus).

The "boulbènes" soils are reddish sands and silts, often mixed with pebbles. The pebbles are more abundant in the higher regions, towards the Pyrenees, than in the valleys, where they disappear almost entirely. Fairly pebbly soft or light "boulbènes" and very fine, heavy, or cold "boulbènes" difficult to work, if not cultivated exactly at the right moment, are found.

If the soil conditions are good a cylindrical mould-board plough requires 99 lb. of average traction per square decimetre (15.50 square inches), whereas a disk plough requires but 66 lb., an economy of 38 %. In dry weather ordinary ploughs penetrate "boulbènes" soils with difficulty and the shares are quickly spoilt, but, if sufficiently heavy, a disk plough will always penetrate. If, however, the soil is wet, the share penetrates easily, whereas the disk plough kneads the soil like mortar, doing damage. As the wet soil should not be turned the disk plough is generally preferable to the mould board plough.

245 - **The Pavani P4 Motor Plough.** — NICOLA, L. C., in *L'Italia Vinicola ed Agraria*, Vol VIII N. 16 pp. 682 683 Casavum Inferiuto November 17 1918

The new PAVANI P4 (1) motor plough, made by the "Moto-Aratrice"

(1) See R. June 1914, No 557 (Ed)

Company of Milan, has the following characteristics: — Weight 5 170 lb., distance between the axles 6.5 ft., distance between the wheels 4.75 ft., maximum height 5.24 ft., diameter of wheels 3.93 ft., width of bands 0.82 ft., motor 15-20 H.P., turns in 24.32 ft., 4 rear wheels, yield 80 %. By means of a special arrangement the motor works with either petrol or benzene.

At the Milan tests the PAVESI P4 motor plough worked three furrows; it is possible to plough to a depth of 13.26 in. The machine was used for ploughing a field and the turning and breaking-up of the soil were complete. The work may be done without difficulty on grass and uneven land, ploughing either shallowly or deeply. The machine works at the rate of 1.96 miles an hour. It may also be used for pulling three harvesting machines and, by means of a pulley, a threshing machine, pressing machine, pump, mill, etc. It may also be used for pulling lorries on roads at a rate of 3.7 to 4.3 miles an hour.

246 - **Motor Trucks for Farm Haulage, in the U. S. A.** — ANDREWS, F., in the *Farm Implement News*, Vol XXXIX, No 4, pp 18 19 + 1 Table Chicago, October 31, 1918

Motors are rapidly taking the place of animal power in hauling farm products in many counties in the United States, where the roads permit. A significant phase of this new development is the growth of regular freight service, by which farmers can send their produce by motor truck directly from the farm to a distant market and thus avoid both the wagon journey and the shipment by rail or boat.

The estimated cost of hauling in wagons from farms to shipping points averaged in 1918 about 30 cents per ton per mile for wheat, 33 cents for maize and 48 cents for cotton.

The cost of hauling by motor trucks per ton-mile comes to 15 cents for maize and wheat, and 18 cents for cotton. These figures are based upon reports made by correspondents of the bureau of crop estimates of the U. S. Department of Agriculture, the estimated costs being based largely on the usual charges made for hiring team and wagon or for motor truck in the various counties.

In 1906 the wagon costs (19 cents for maize or wheat and 27 cents for cotton) were lower than those for 1918, but the motor truck costs were much lower in 1918 than even the wagon costs of 1906, due to greater efficiency of the motor truck.

Motor truck hauls in 1918 from farm to shipping point averaged 11.3 miles, while wagon hauls averaged 9 miles; and a motor truck made 3.4 round trips per day over its longer route of 11.3 miles, while wagons made 1.2 round trips per day of the 9 mile distance.

The motor trucks generally used by the farmers are not the large trucks, but the small ones whose nominal capacity, is usually one to two tons. In many countries the trucks used for hauling are transformed passenger cars. In some cases light wagons are attached as trailers to ordinary passenger cars. In North Dakota and California tractors, each drawing several wagons, are used for hauling grain.

The author next deals with the average loads hauled by truck and wagon in 1918. Of 1 473 county reports which were received, 898 mentioned motor trucks as being used in hauling from farms to shipping points.

A table gives details as to the cost of hauling wheat, maize and cotton, the cost per mile, the number of round trips per day, and the distance run, both for motor trucks and wagons in the various divisions of the United States.

One of the chief limitations in the use of the motor truck is the condition of the roads and in many cases a beginning of motor truck use has been noted when the roads were improved. Some farmers say that after their harvest there was no work for their horses to do but haul and that motor trucks would not be an economy.

247 - **Review of Patents.** - DENMARK - NEW-ZEALAND - SWEDEN - SWITZERLAND - UNITED-KINGDOM - *Sources, see Review, Jan., 1919, No. 104* - FRANCE. *République française, Office National de la Propriété Industrielle, Paris*

TILLAGE MACHINES AND IMPLEMENTS. - France (1) 487 948 Cultivator hoe replacing the plough and other tillage implements (1); improvement, 1st. addition No. 20 608.

New-Zealand : 39 501-39 687 Plough lifting mechanisms.

Sweden : 44 230 Motor plough ; 44 483 Plough lifting device for motor ploughs.

Switzerland : 79 907 Spring tooth harrow ; 79 908 Motor plough.

United Kingdom : 119 562 Rotary soil cultivator ; 119 576 Land roller ; 119 883 Plough for tractor.

MANURES. - *New Zealand* : 39 206 Fertiliser and process of making same.

DRILLS AND SEEDING MACHINES. - *Sweden* : 44 386 Tuber planting machine ; 44 544 Potato hand planter , 44 565 Hand seeder.

Switzerland : 79 748 Seeding machine.

VARIOUS CULTURAL OPERATIONS. - *Sweden* : 44 543 Horse hoe

CONTROL OF DISEASES AND PESTS OF PLANTS - *Switzerland* : 77 911 Insect trap ; 79 752 Process for treating fungous diseases of plants 79 753 - 79754 Animal traps.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. - *France* : 488 659 Sheet for gathering apples ;

Sweden : 44 228 Combined harvesting and threshing machine; 44 522 Harvesting attachment for mowers.

Switzerland : 79 719 Tedder.

MACHINES FOR LIFTING ROOT CROPS. - *Denmark* : 23 418 Root topper and digger ; 23 617 Turnip topper and digger ; 23 628 Device for potato digger.

Sweden : 44 324 Beet digging machine.

United Kingdom : 119 743 Potato digger.

THRESHING MACHINES. - *Sweden* : 44 228 Combined harvesting and threshing machine.

(1) See R. Nov., 1918, n. 1277. (Ed)

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF CROPS. — *New Zealand* : 38 961 Flax-blade sorting, elevating, conveying, and bench-loading apparatus ; 40 622 Travelling chain or cable for flax treatment.

Switzerland : 79 751 Apparatus to prevent spontaneous combustion of hay ricks.

FORESTRY. — *Sweden* : 41 260 Tree felling machine.

TRACTION AND STEERING OF AGRICULTURAL MACHINES. — *France* : 486 767 DESSAULES tandem tractor (1) ; improvements, 1st and 2nd additions Nos. 20 628 and 20 629.

SWEDEN : 44 452 Tractor ; 44 480 Driving wheel for motor plough ; 44 593 Motor for milking machine.

United Kingdom : 119 840 Tractor coupling.

POULTRY FARMING. — *Sweden* : 44 450 Self feeder for poultry.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Denmark* : 23 422 Implement for digging and cutting turf ; 23 427 Dough kneading and mixing machine ; 23 567 Bottle washing machine.

New Zealand : 38 961 Flax-blade sorting, elevating, conveying and bench-loading apparatus ; 40 622 Travelling chain or cable for flax treatment.

United Kingdom : 119 531 Machine for comminuting potatoes or other tubers, or rice, etc., in the manufacture of flour or starch ; 119 597 Machine for washing bottles, jars, etc.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *New Zealand* : 39 266 Ham and bacon curing.

DAIRYING. — *New Zealand* : 39 917 Cheese press.

Sweden : 44 074 Rotary churning device ; 44 197 Butter working machine ; 44 227 Milk heating apparatus ; 44 593 Motor for milking machine

Switzerland : 79 950 Churn ; 79 951 Churn driven by a hydraulic engine.

VARIOUS. — *United Kingdom* : 119 701 Hydraulic ram.

AGRICULTURAL INDUSTRIES.

218 — **Comparison Between the Acidity of Wine and that of the Must.** — PORNTAEGER, A. in *Le Stazioni sperimentali avarie italiane*, Vol. I, Pt. 3-6, pp. 162-165. Modena, 1918.

The author quotes several papers which state that during the passage of must to (healthy) wine the acidity decreases. The author studied five samples, analysing both the filtered must and the wine obtained by the fermentation of this must and found that in four out of these five the acidity of the wine was not appreciably lower than that of the musts, indeed, in three samples the wine was more acid than the must (8.91, 5.21, 4.13 respectively as compared with 8.55, 3.50, 3.86 per 1000 of acidity expressed as tartaric acid). The question deserves a deeper study.

219 - Alcohol Production from Marine Algae. — KAYSER, in *Feuille d'Information du Ministère d'Agriculture* Y et XXIII, No. 40, p. 8 Paris, December 3, 1918

In a note presented to the 'Académie d'Agriculture' in April, 1918 (1), the author drew attention to the transformation of the carbohydrates of algae into alcohol. He now describes some subsequent tests. The algae used were *Laminaria — flevicaulis* and *L. saccharina*, collected on the Breton coast. As they deteriorate quickly they were subjected to rapid artificial drying.

The dried algae were cut into small pieces and treated either with pure water or water of varying acidity, and placed in the autoclave at 100° or, as proved preferable 120 to 125° C. In the case of acid attack the acidity was always neutralised by potassic solutions up to 0.7-1 0/100. Much higher yields were obtained with the acid than the fresh water. Increased acidity gave higher yields, and better results were obtained with sulphuric acid than hydrochloric acid. The yield was further increased and fermentation made more rapid by adding a little organic nitrogen (1.5 to 2 % of malt dust).

With acidulated water in the autoclave at 122° for ½ hour, and with malt dust, more than 11 pints per 100 lb. of dry matter were obtained. When retreated the residue yielded a further 6 pints.

Fine lactic fermentations were also obtained not only with the aqueous maceration liquid, which contained mannite, but also with those obtained with acids and the addition of calcium carbonate. The carbohydrate of *Laminaria* may, therefore be transformed into either alcohol or lactic acid. Various mineral elements (potash, iodine, etc.) may be obtained from the dregs. The rational and methodical use of *Laminaria*, by improved processes, should prove a very profitable new industry.

220 - Contribution to the Study of the Bread making Properties and the Mycology of Maize. — BRÜDELLEIN, J., in the *Universit. de Genève, Institut de Botanique, Series IX, 11 VIII, Theses No. 608* 87 pp. Geneva, 1917

In his thesis presented to the Faculty of Science of the University of Geneva, the author first reviews briefly the work done on the fermentation of wheat flour and the few studies on that of maize flour. In the following chapter he discusses the technique and choice of materials utilised in these researches and the procedure necessary to make bread with maize. The 3rd and 4th chapter contains a study of baking and fermentation. In the 5th chapter is considered "artificial" baking (by the setting-free of carbonic acid within the paste itself by a mixture similar to that known as "self-raising flour", "baking powder", "Backpulver", "levain artificiel", and, wrongly, "yeast"), and, in the 6th, the bread itself. The 7th chapter contains a brief summary of the physiological and food value of maize, and one on pellegria. In the second part of this thesis the author discusses two new *Mucorinae* found during his studies and called by him *Mucar lusitaniensis* n.sp. and *Rhizopus Maydis* n.sp.

The author draws the following conclusions from his investigations: —

(1) See R., May, 1918 No. 569 (Ed.)

Bread may be made from maize flour free from any mixture. Flours with the highest starch content should be chosen. Yeast obtained with *Mucor Praini*, *Bacillus levans* and baker's yeast, is the most active. Some *Mucorinae* cause the paste to rise, but their action is slower than that of yeasts and bacteria.

The fermentation of maize paste is similar to that of wheat; the principal obstacle to bread-making is its lack of elasticity and excessively porous structure. These defects are due to the composition of its gluten which differs from that of wheat. The structure of maize bread is much more compact than that of wheat bread, and it absorbs water much more rapidly, making it more difficult to keep. From a point of view of food value it is absolutely insufficient, combining the disadvantages of heavy bread with those of maize. On account of its compactness it is soon saturated without, however, having absorbed the necessary amount. It is, nevertheless, easily taken, and its consumption does not appear to give rise to any particular disorder.

The action of *Mucor lusitanicus* n.sp. and *Rhizopus Maydis* n. sp. is not vigorous enough to allow them to be used as yeasts

251 - **Soybean Milk.** - *Schweizerische Milchzeitung*, Year 44, No 93, p. 1. S. Haffmischen, November, 1918

Soybeans soaked for about 12 hours in cold water, then crushed and re-soaked in the immersion water and finally pressed over a sieve, yield a milky liquid. When fresh this "soybean milk" has a slightly acid reaction, is microscopically homogenous and, in its physical properties, resembles cow's milk. Lactic fermentation bacilli are active in it. It contains 3.13 % of casein and 9.89 % of fat. As the fat is rather oily churning is impossible, but good cheese may be obtained. As this "soybean milk" and its products are rich in phosphates they are much to be recommended as food for children.

252 - **Drying Plums in Oregon, U. S. A.** - LEWIS, C. F., BROWN, F. R., and BARSS, A. F., in the *Oregon Agricultural College Experiment Station, Division of Horticulture, Bulletin* No. 145, 36 pp. + 78 Figs. + 4 Tables Corvallis, Oregon, July, 1917

In 1911, the Division of Horticulture of the Experiment Station of the Agricultural College of Oregon made investigations into plum growing in the state. The investigations, made into 700 plum orchards in 9 counties showed great differences in the methods used and the type of building or drying the fruit. Immediately after these investigations the Experiment Station began a study of plum drying with a view to standardising the produce. The bulletin under review was published for the benefit of plum-growers, especially those drying the fruit for the first time. Growers should make a careful study of the cost of producing and drying plums, and try to obtain first quality produce.

The authors studied the collection of the fruit, frequently made by shaking the trees, a method giving a large proportion of incompletely ripe fruit. The most common practice is to collect the fruit in three lots, the first by picking up the fallen fruit, the two last, by shaking the tree.

Of recent years there has been a tendency to harvest too soon, from September, to 6, or 10 days earlier than the normal harvest season, the object being to avoid damage done to the fruit by rain. The authors do not oppose shaking the trees, but advise waiting till a few light shakes will cause the largest number of fruit to fall.

Chemical analyses made by the authors show the sugar content to increase rapidly during the last days of ripening. From harvest time till the fruit falls naturally the increase in weight is 1.6 %, most of which is sugar. The ideal fruit for drying is completely ripe, fallen naturally, plump with golden yellow flesh. Sixty pounds of such plums will yield 25 lb. dry fruit (or 35 %). Some growers sort the plums while they are on the drying trays, but most of them only collect sound fruit. The authors tested the two methods extensively; the more practical seemed to them to collect all the fallen fruit and to sort them before placing them on the trays. The sorting is done by hand, but it would be more economical to spread the fruit on endless belts which will carry it to the sorters before it goes to the dipping machine. Mechanical sorters of a 25 to 50 ton capacity may be bought for \$ 50 to \$ 100. Opinion as to the kind of bath to use varies greatly. Some growers dip the fruit in hot lye water, some in boiling water, some in cold water, and some dry it without washing it at all. Dipping in a boiling alkaline mixture may be done by hand or by machine; dipping by machine costs 70 to 85 cents per ton, by hand it costs more. With a modern machine four men can sort, wash, and place on the shelves from 500 to 600 cases in 10 hours. The chief advantage of dipping in lye is to shorten the time of drying. General practice and the authors' experiments confirm this theory.

A table summarising the results of the experiments shows that fruit which has not been soaked in lye requires 5.3 hours more to dry than treated fruit. Soaking the fruit causes a loss in weight of about 2 %; fruit thus treated must be washed a second time to remove all danger at the time of consumption. Washing in boiling water gives excellent results. Some growers use warm or tepid water instead of boiling water. There is no real objection to using lye if the fruit be well cleaned and thoroughly rinsed with fresh water. In Oregon, as a rule, fruit is not treated with sulphuric acid in closed rooms.

The methods, material and buildings for drying are studied successively. The rate of evaporation depends largely on the evaporator used and the producer should examine which conditions of temperature and air circulation will give the best quality produce. Drying plums requires much air, which should circulate at the rate of 600 ft. a minute. The initial evaporation temperature should be from 130° F. to 145° F., and the final temperature should not exceed 160°. There should be much moisture till the fruit is warmed through, when it should be decreased till it is equal to the percentage of moisture desired in the dried fruit; the authors' experiments showed the most suitable moisture percentage to be 17 to 18 %. The appearance of slowly dried fruit is often bad (in 1914 such fruit was attacked by moulds). The appearance, texture and flavour of the fruit

are better when it is dried relatively quickly. Should drying be abnormal long the cause should be sought either in the method applied or the construction.

The material required is not considerable — a dipping basin with an arrangement to keep the water boiling is necessary in every installation; well-built and easily cleaned tanks should be near the basin, though some mechanical dipping basins do not require extra tanks, the dipping and rinsing forming part of one operation; trucks are also necessary to carry the trays to their places. After discussing the buildings the authors advise erecting them so that the fruit always passes in the same direction. The dried fruit stoves should be some distance from the main building so that the crop may be saved should fire break out in the dryer; this is especially important in the case of large capacity dryers.

Steam or hot air dryers may be used; the first are very expensive and little used. Descriptions are given of two kinds of hot air dryers used in Oregon — the tunnel dryer, and the stack dryer. In the second type the hot air passes through the shelves of fruit, whereas in the first type it passes above and below rather than through the shelves. The first type of dryer is made of a group of almost horizontal wooden tunnels placed side by side near a furnace in groups of 3, 6, 7 or 8. Each group of 3 or 4 tunnels requires a separate furnace. The tunnels are from 20 to 50 ft. long, though the authors obtained the best results with tunnels not more than 16 ft. in length, and believe no advantage is derived by making them more than 22 ft. long. The tunnels are from 4 to 6 ft. high and the slope from one end to the other varies from 2 to 3 ft. Though some tunnels are made with a slope of 3 in. to the foot the authors believe it should not exceed 2 inches to the foot. The trays are placed on cleats or rollers nailed to the sides of the tunnels, below which are the furnace and hot air chamber, which extends beneath all the tunnels. An iron sheet is often placed above the furnace to reflect the heat and prevent too rapid an upward movement of the hot air.

A detailed description with plan and figure is given of the ZIMMERMAN tunnel evaporator, composed of 24 tunnels, divided into three groups of 8, heated by two stoves. The steam pipes, 16 inches in diameter, are arranged round the hot air chamber, the pipes of both stoves being connected with a single flue. The hot air enters the tunnel through a throat making it possible to regulate the heat so that it does not strike the fruit directly. The trays ($30\frac{1}{2} \times 37\frac{1}{2}$) are made of galvanised tray cloth between two spruce frames. Each tunnel can take 96 trays, placed in threes on twelve slides. The tunnels have double floors, solid partitions, and of tongue and groove ceiling (in the future the ceiling will probably have double walls filled with paper). The tunnels are 22 ft. long with a slope of 3 ft. between the lower and upper ends. Ventilators 30 in. wide ensure aeration. This evaporator can hold 1000 cases of plums; it may also be used for drying apples.

A smaller evaporator, belonging to Mr. EDDENS of Dundee, Oregon, is also described. Built in 1916, it cost \$1300, not including remuneration

for the owner's work. The reinforced concrete hot air chamber, 12 ft. high, has two crossed iron pipes which support the flue pipes. The distance, 8 ft., between these pipes and the tunnel is excellent, and reduces the danger of scorching the fruit to a minimum. The tunnels have a filled solid partition of 2 in. planks, and tongue and groove floor and ceiling. The ventilator is divided, with a separate shaft for each tunnel. The trays, of galvanised tray cloth between double frames, slip into the tunnel on telephone insulators, used as rollers, fixed to the wall. The trays are somewhat closer together near the top. The doors, of wood covered with oilcloth, are easily raised and lowered.

The GEORGE PALMER (Rosedale district, South Salem, Marien County, Oregon) is described as a typical stack dryer. The heating system is similar to those already described, with a hot air chamber, 12 ft. high, made of hollow tiles, the heat being supplied by a large stove and 9 rows of pipes with 3 drums. The air to be heated is obtained from within the building, thus economising fuel. The hot air passes directly over the fruit trays. It is possible to raise all the superposed trays except the lowest one. The galvanised wire cloth trays have high frames which prevent the plums from being crushed when the shelves are piled up. The ventilator is sufficiently high to give a continuous current of fresh air. There are two rows of stacks, placed back to back, each row having 13 stacks of 16 trays, 25" x 42". The dryer has a capacity of about 200 bushels of fruit. Plans and sectional figures of the dryer are given.

The ordinary kiln driers used to dry apples and other fruit chiefly in New York State, are not suitable for drying plums. An experimental fruit dryer is being built at the Oregon Experiment Station.

253—**The Canada Hardwood Distillation Industry** — *The Board of Trade Journal*, Vol. CI, No. 1131, p. 161. London, 1918.

The hardwood distillation industry was first established in Canada some twenty years ago with a small plant at Feneion Falls, Ont., having a capacity of 20 cords of approximately 40 tons of hardwood per 24 hours. The industry has steadily grown, and to-day there are twelve plants in Canada with a total carbonising capacity of over 500 cords, or 1 000 tons of hardwood, per 24 hours. From this raw material there is a production of : — 75 000 tons of charcoal, used for smelting and fuel purposes ; 13 000 tons of acetate of lime, required for acetone and acetic acid ; 1 250 000 gallons of methyl alcohol, required for varnishes, soap, methylated spirits, etc. Among other derivatives are acetone oils, formaldehyde, acetic anhydride, methyl acetate, and sodium acetate, the last three being new products in Canada since the war.

INDUSTRIES
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254 **Production, Supply, and Industry of Milk and its Products, in Italy.** — BRENTANA, D., in *Il Moderno Zootro*, Series V, Year VII, No. 10, pp. 218-223. Bologna, Oct. Dec. 31,

In Italy the production of milk increased continually before the war, rising from 20 million quintals (1 quintal = 1.968 cwt.) in 1894 to 35 million quintals in 1910. In 1910 the production for the other European countries

was : Germany 250 000 000 quintals, France 84 450 000, Austria-Hungary 51 000 000, England 27 000 000, Holland 26 300 000, Sweden 25 000 000, Denmark 22 400 000, Belgium 16 000 000, and Switzerland 15 000 000. In 1914 the production of milk in Italy had reached 38 000 000 quintal. About half of this was consumed as milk, the other half being made into butter and cheese, part of which was consumed in the country and a large quantity exported — about 320 000 quintals of cheese and 27 000 of butter. This exportation suffered greatly through war conditions and legislation. In 1914 it was prohibited. This first decree lasted but a little while on account of the resultant crisis, especially for cheeses owing to their perishable nature. In 1915, however, the prohibition was again enforced with the object of assuring supplies for the army. The acquisitions rose rapidly to 40 000 to 50 000 quintals a month, and then fell, chiefly on account of the decrease in milk production. At the present day the production of milk in Italy is half what it was before the war. The price of milk (wholesale from the producer) has also risen from 15 *lire* (11s. 10 $\frac{1}{2}$ d. *at par*) to 20 *lire* (15s. 10d.) in 1916, to 30 *lire* (23s. 9d.) in 1917, and to 45 *lire* (35s. 7 $\frac{1}{2}$ d.) in 1918. In the towns the price varies from 55 (43s. 6 $\frac{1}{2}$ d.) to 80 *lire* (63s. 1d.) per quintal.

In October 1918, at the quarters of the "Società agraria di Lombardia" at Milan, was held a congress organised by the National Union of Social and Cooperative Dairies and the "Associazioni di industriali e commercianti di latte e latticini" (Associations of those engaged in the industry and commerce of milk and its products) of Upper Italy, to discuss the means of increasing rapidly the milk production in Italy. The measures recommended were :— the regulation of the milk market, the protection of pig raising (to utilise the whey), the assurance of a supply in the towns during winter, the suppression of small home dairy industries carried out to evade taxation and requisitions. The Congress also made the following proposals : —

- 1) A study of the measures necessary to restore the dairies of Venetia and Friuli and mountain agriculture ;
- 2) the encouragement of the local manufacture of cheese-making equipment, with new forms of industrial organisation ;
- 3) experimental and practical re-organisation of institutes for instruction and scientific research in cheese-making ;
- 4) and 5) the resumption of foreign commerce and the inclusion of cheese in the renewal of the customs tariff ;
- 6) the formation of a permanent committee to protect the dairy industry.

255 — **The Influence of the Degree of Acidity of Milk on the Rate of Destruction of the Peroxydase by Heat.** — BLOM, A. and VAN DAM, W., in *Verhanden van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstations* No. XXII, pp. 156-197 + 11 Tables + 1 Fig. The Hague, 1918.

The control of the pasteurisation of milk has recently been enforced legally in certain countries, especially Holland (by the royal decree of May 2, 1917). This control is based on STORCH's reaction ; the milk + hydrogen

peroxide + paraphenylene-diamene gives a blue colour which is darker in proportion as the peroxydase content is higher. Heat destroys this diastase, and the authors studied the extent to which the degree of acidity of the milk can influence the rate at which the peroxydase is rendered inactive at a given temperature (70.55° C.). The experiments showed the electro-metric determination of milk at 70° C. to be possible only in the case of fresh milk taken with the greatest care. The hydrogen-ion concentration at 70° C. was 2.5 to 3 times higher than that at normal temperatures.

The addition of lactic acid to the milk in quantities making pasteurisation still possible does not appreciably affect the rate of destruction of the peroxydase at 70.55° C. The addition of a small quantity of fixed alkali or ammonia, however, distinctly hastens the destruction of the diastase which becomes inactive in five times less time than required for milk to which alkali has not been added.

256 - Production of Veal or Production of Milk ? — GOUIN, A and ANDOUARD, L., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 9, pp. 332-336, Paris, 1918

During the food crisis it is to the public good to produce less veal and to use the milk from which this meat is obtained for human consumption. One kilogramme of live veal contains about 420 grammes of food elements - flesh and fat — whereas one kilogramme of average milk contains 170 grammes.

If as an example be taken a calf of good breed, maturing normally, and making a uniform gain of 1 kilogramme daily on a milk ration corresponding to $\frac{1}{6}$ of its weight, as is usual, the following figures are obtained for the successive stages of its growth :—

Age in days	Weight lb	Gain lb	Milk con- sumed lb	Food Value		Ratio between meat and milk
				of gain in meat grammes	of milk consumed grammes	
0 to 10	88 to 118	22	165	4 200	12 750	1 to 3.04
11 " 20	112 " 132	22	211	4 200	15 640	1 " 3.72
21 " 30	124 " 154	22	237	4 200	16 360	1 " 4.37
31 " 40	156 " 170	22	275	4 200	21 250	1 " 5.6
41 " 50	178 " 198	22	308	4 200	24 140	1 " 5.75
51 " 60	200 " 220	22	347	4 200	26 860	1 " 6.40

Thus, after having consumed at the beginning a quantity of food three times greater than its growth produces in man the calf ends by requiring six times more than it can give back as human food. When the calf is allowed to reach 220 lb., the 132 lb. gained since birth represent a food value of 55 lb., and it has deprived us of over 153 galls. of milk with a food value of 262 lb., more than five times that of the meat obtained. It is not true that the meat of very young animals is unfit for consumption (1).

(1) See R. April, 1916, No. 455; Oct., 1906, No. 1121. (*Ed.*)

257 - Preserving Fodder by Selected Ferments ; Investigations in Italy. (1) — GORINI, C., in *Le Stazioni sperimentali agrarie*, Vol. I, Pt. 3-6, pp. 199-213 + Bibliography of 35 Publications. Modena, 1918.

A series of investigations outside Italy having confirmed the author's theory on the utilisation of selected ferments in ensilage (1907) he has made a summary of the discussions and investigations on ensilage, including his own studies, which he summarises as follows :—

These studies were begun in 1904 during the scientific debate between those holding the bacterial theory and those holding the physiological or autolytic theory of the transformation factors occurring during ensilage. Leaving aside the theoretical aspect of the problem, the studies showed:—

1) Bacterial intervention, considered not indispensable by some, is constant and unavoidable in practice.

2) Successful ensilage is closely connected with the bacterial conditions of the silo.

3) Consequently, bacterial intervention cannot be considered negligible (as in the case of the autolytic theory), and may be advantageous or injurious according to the nature of the predominating bacterial flora.

4) The bacterial flora of normal silos is comparable to that of cheese and, taking the nature of the predominating bacterial flora as a basis, silos may be classed as *lactic* or *butyric*, rather than *sweet* or *acid*, as they differ far more in their volatile acid content than in their degree of acidity.

5) Preference should be given to the lactic silo from the point of view of economics, the cheese industry, and hygiene, as well as from that of cattle feeding and the milk supply, especially for children and invalids.

These results give a new turn to the preparation of ensilage, reducing it to a process of preservation by lactic fermentation, such as frequently occurs in nature. In ensilage, therefore, it is necessary that the lactic bacterial flora should predominate as rapidly as possible. This is not always easy and depends on many complex conditions the realisation of which is inhibited by many natural causes (variations in weather conditions, quality of the fodder, etc.) or technical causes (construction of the silo, method of filling and compression, etc.) ; it depends above all on the presence of lactic ferments sufficiently numerous and virulent to predominate rapidly over antagonistic bacteria. Maize, for example, is very suitable for ensilage because it is the material richest in lactic ferments ; herbaceous material is less suitable because it is often relatively poor in lactic ferments. Silos insufficiently or over heated are the most dangerous because too low a temperature does not favour the development of the lactic ferments and too high a temperature prevents this development.

To make up for the shortage of the necessary bacterial flora due to defective natural or technical conditions favouring spontaneous lactic fermentation, the proposed addition of selected ferments is useful and often

(1) See also R. Jan and Fehr., 1916, Nos. 109 and 232 ; R. Feb., 1918, No. 221. (Ed)

necessary, hastening the fermentation process and greatly attenuating the difficulties described, especially that arising from the degree of heating of the ensilage. Strong lactic ferments allow the ensilage to reach a fairly high temperature (about 50° C.), even though it be for a short time only, thus causing a more active and a purer lactic fermentation, free from volatile and secondary products.

These theories are confirmed by numerous works published outside Italy, and agree perfectly with the accepted eclectic autolytic-bacterial doctrine. Moreover the use of selected ferments is also in accordance with pure autolytic theory. Even when bacterial life is considered to be excluded it still exists inevitably, and the use of ferments helps greatly, by the strong acidification caused, to remove all other bacterial activity. If maize silage, on which the physiological theory is based, gives results at all temperatures, it is because it lends itself best to rapid lactic fermentation caused by the numerous lactic bacteria present.

The results obtained by the author and other workers seem to show the work to be sufficiently advanced to prove the value of selected ferments in ensilage to be equal to that assigned them in cheese-making. The present shortage of fodder makes it necessary to utilise everything of value as a food by easy and cheap methods of preservation at all seasons. The author, therefore, proposes without giving up systematic experiments that an abundant distribution of selected ferments should be distributed among the travelling chairs of agriculture and farmers. All necessary precautions must, of course, be observed, instructions given as to the best methods of using the ferments, and the bacteriological and chemical control necessary to assure the best results exercised. This would prove a good, simple and practical method of propaganda for ensilage, as the method requires no special installation nor rigorous rules as to the temperature of fermentation, which may vary within fairly wide limits (from 30 to 50°C.). Whatever the transformation factors of silaged fodder may be, the addition of lactic ferments will in all cases perfect the process, giving economic and hygienic advantages to animal production, the cheese industry, and the milk supply.

258 - Experiments on Salting Fish in the United States. *Commerce Report*, No. 267, p. 597 Washington, November 1, 1915

Dr. FRESSLER, of the U. S. Bureau of Fisheries, has proved experimentally that impurities present in the salt, even in small quantities only, have a decided influence on the salting process and the quality of the salted product. Pure sodium chloride penetrates much more deeply and thoroughly into the fish. Penetration is delayed by the addition of a small quantity of calcium chloride to the pure salt brine, still more so by magnesium chloride, and most by sodium sulphate. Calcium and magnesium chloride are common, almost constant, impurities of salt, and it is clear that they may prevent fish from keeping well during hot weather by prolonging the time necessary for the penetration of the brine.

These impurities also produce a visible effect on the quality of the

fish. Pure salt gives tender, brownish or greyish flesh ; small quantities of impurities give much harder flesh ; magnesium chloride, which also keep the skin bright, has the greatest effect of this kind. Small quantities of calcium chloride make the fish hard, and larger quantities loosen the skin from the flesh, and make it viscous. Calcium chloride, and, to a greater extent, magnesium chloride, make the flesh white. As the effects of these impurities are known it is possible, not only to salt fish more rapidly and thoroughly, but to harden it to the degree required.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- 259 - The Destruction of Vines by Asphyxiating War Gas in Champagne, France. —
VERMOREL, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV,
No. 40, p. 1111 Paris, December 18, 1918

The author reports that when vine-growers of Champagne wished to start cultivating their vines again, it was found that, in many parishes, especially that of Celles, 10 miles from Reims, the branches came away in the hands as they were touched. The stock appear perfectly healthy, but are really dead.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERAL

- 260 - Diseases and Pests of Plants Cultivated in the Dutch Indies in 1917 (1). — VAN
HALL, C. J. J., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 33, pp. 1-12,
Batavia, 1918

This publication, issued by the "Laboratorium voor Plantenziekten" (Plant Pathology Laboratory), first summarises the data supplied by the Experiment and Agricultural Stations of the Department of Agriculture, Industry and Commerce, then gives the reports made to the Laboratory during the year 1917.

Phytophthora Faberi attacked several hevea plantations, not only in the rainy season, but also in the dry season. The continuous rains during the monsoons caused an abnormal falling of the leaves and many diseases of the leaves. These diseases did no great damage. "Djamoe-oepas" (*Corticium javanicum*) occurred here and there in plantations. New root diseases (*Poria* and *Ustilina*) were reported in the older plantations. In the east of Sumatra considerable damage was done to rubber trees by violent winds.

Sugar cane suffered little from fungi or insects. The heavy rain at the beginning of the planting season favoured gommosis. The variety E. K. suffered most.

In central Java the coffee trees were damaged by the "gramang" ant (*Plagiolepis longipes*). Preventative measures gave good results. In the

(1) See R. O. t., 1917, No. 978 (Fd)

Kediri residency a species of *Pseudococcus* living on the roots, observed for the first time, proved very injurious to *Coffea robusta*. As in 1916, damage was done by *Cryphalus hampei* in the west of Java.

Cacao trees were attacked by *Gracilaria cramerella*. The fruit developed very irregularly so that the destruction of the insect by the simultaneous removal and destruction of the fruit could not be carried out satisfactorily. Injury by *Helopeltis* was less serious than in preceding years.

Phytophthora, favoured by the continual rain during the first half of September, did much damage to young tobacco plants. Although tobacco thrips appeared in Central Java to a larger extent than in former years, its attacks were not serious.

At Deli some of the plantations in the plains suffered badly from the larvae of *Heliothis*. "Toa-toh" (*Lita solanella* = *Phthorimaea operculella*) (1) and *Leptoterna*, which makes small holes in the young leaves, did greater damage than usual.

Helopeltis and root fungi did much damage in tea plantations.

Teak plantations were attacked by *Calotermes tclonac*, *Duomites ceramicus*, and *Hybloea pura*.

The forest reserves were attacked by a hitherto unknown pyralid which ate the young buds.

As in former years "Sonokling" (*Dalbergia latifolia*) stands were attacked by mould, those of mahogany (*Swietenia Mahagoni*) by the larva of a pyralid.

In the west of the Preanger residency considerable damage was done by insects piercing the roots (probably identical with *Phassus damor*). "Rasamala" (*Altingia excelsa*) and "kriiceng" (*Quercus fagiformis*) suffered most.

The following diseases of native crops were reported. Except in a few districts rice in Java suffered severely from non-parasitical root rot, due to the heavy rains during the wet season. Floods did much damage in many parts of Java, amongst others, the residencies of Rembang and Kediri. "Walang sangit" attacked the rice fields in the Bantam residency. In Besoeki, *Cecidomyia* was very destructive, in the Cheribon residency, "padi-boorder". In Sumatra considerable damage was done by rats and *Podops*.

As usual maize suffered severely from "omo lyer" disease, caused by *Peronospora Maydis* (= *Sclerospora javanica*) (2).

Soybean crops were injured by the heavy rains, especially in the Rembang, Pekalongen and Kediri residencies.

Coco plantations in Java and Sumatra were damaged by larvae of *Bracharlona*.

As, owing to shortage of tonnage, a longer period than usual elapsed between harvest and shipping, many insects did more or less serious damage in the storing sheds.

(1) See R, Oct., 1918, No. 1183 and R, Jan., 1919, Nos 138 and 140 (Ed)

(2) See No. 264 of this Review (Ed)

RESISTANT
PLANTS

261 - Rust Resistance of Oats Controlled by Artificial Infection with *Puccinia* in Damp Warm Greenhouses, in the United States. — See No. 186 of this Review.

262 - Eggplants Resistant to Rot Caused by *Bacillus Solanacearum*, in the Philippines. — See No. 189 of this Review

MEANS
OF PREVENTION
AND CONTROL

263 - Patents on the Control of Plant Pests and Diseases. — See No. 217 of this Review

DISEASES
OF VARIOUS
CROPS

264 - Experiments on the "Lyer" Disease of Maize, in Java (1). — PALM, B., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 32, pp. 1-78 7 + 1 Fig. + 7 Plates. Batavia, 1918.

The symptoms of the "lyer" disease of maize in Java can be divided into three different types.

First type: — the attacked plants remain small with narrow leaves; they are yellow or greenish yellow. Often plants of this type lie down in consequence of the poorly developed root system.

Second type: — the plants are of normal development with yellow striped leaves, emerging from a common base in the basal part of the leaf.

Third type: — the diseased plants are of normal appearance, only the basal leaves show narrow, sharply defined stripes, yellow or brown in colour. The stripes very seldom anastomose at their basal part.

The "lyer" disease in Java is caused by *Sclerospora javanica* nom. nov. (Syn. *Peronospora Maydis*, Raciborski 1897, *P. Maydis* Rutgers, 1916, *Scl. Maydis* Butler 1913 pro parte). Only a conidial fructification has till now been found. The resting spores, described by RACIBORSKI, are spores of a *Paramoecium*, the chlamydospores and oospores which RUTGERS supposed to belong to this species having been proved to be resting spores of a *Pythium*.

The maize *Sclerospora* from British India, described by BUTLER, is not identical with the Javanese one on maize. It is to be named *Sclerospora Maydis* Butler. This species also occurs in the Philippines.

The conidia of *Sclerospora javanica* germinate with a germ tube which penetrates the leaf through one of the stomata. The infection power of the conidia is retained about one day if lying exposed on the leaf; when in or on the ground the infection power seems to be lost after 4 days. The conidia are disseminated by the aid of the wind. Studies in the field have proved the presence of conidia in the air and have shown that the conidia are able to travel over a distance of more than two kilometers without losing their infection power. The maximum distance of dissemination remains yet to be determined.

A great number of infection experiments have shown that the conidia are probably the only and at any rate the most important agents for the dissemination of the *Sclerospora* disease. Their restricted longevity is compensated by production in large numbers. Earlier workers regarded the resting spores as the more, if not the only, important ones in this respect. But oospores are as far as known never formed by the fungus,

(1) See R, February 1917, No. 197 and R, October 1917, No. 978. (Ed.)

and if they are some formed they are at any rate of very little importance as spreaders of the disease. Furthermore the mycelium which is sometimes to be found in the seeds of diseased plants never gave rise to diseased plants in the author's experiments.

The following conclusions seem justifiable :—

a) There is no danger in planting in " infected " soil.

b) Seed material from a diseased crop does not carry the disease to the following crop.

The incubation time usually lasts from 10 to 20 days, one month, however, being no exception.

The liability of *Zea Mays* to infection is rather great at the seedling stage and augments till three or four leaves are formed. After this stage has been reached it begins to diminish; a plant three or more weeks old seems no longer liable. Experiments concerning the influence of cultural conditions (way of planting, manuring, tillage of soil, etc.) on the liability of plants to infection do not yet permit any conclusions.

The establishment of the fact that the disease is propagated only by means of the conidial fructification, gives a new aspect to the question of combating the disease. No effect can any longer be expected from soil disinfection. And, since no success was obtained by spraying with fungicides, the most promising way seems to be to forbid maize culture over large areas during a certain part of the year. Experiments on this line are in progress.

205 - **Rareness of Disease in Rubber Plantations in Indo-China.** See No. 203 of this Review

66 - **Diseases and Pests of Tea on the East Coast of Sumatra.** BERNARD, C., in *Mededeelingen van het Instituut voor Indische Landbouw*, No. 54, pp. 1-21 + 7 Figs. Batavia, 1917.

In four chapters are reviewed, 1) root diseases, 2) animal and vegetable parasites, 3) *Helopeltis* and *Pachypeltis*, 4) *Brempalpus obovatus*.

Tea grows remarkably well on the east coast of Sumatra and usually resists all diseases; cryptogamic diseases of the root alone appear occasionally on a large scale in some plantations. Local conditions favour the growth of fungi, so that certain districts appear badly infected. It is necessary to clear the land thoroughly, removing all tree-trunks, stumps, branches and roots; this is the surest method of controlling root disease. It is pointed out that it is inexact to speak of a determined cryptogamic disease of the roots, as, for example, *Fomes* in Sumatra or *Rosellinia* in Ceylon. In many cases neither of these fungi are concerned. It matters little at such times to determine the different species, it is important only to know that numerous fungi may develop on the decomposing underground organs of the plant from which they may pass to the roots of living plants which they may kill rapidly. The best method of control is to dig to a depth of 19 to 23 in., remove all remains of wood and isolate stumps which cannot be removed by deep ditches to prevent the propagation of the fungi.

The most important vegetable parasites are brown blight (*Laestadia*),

red rust (*Cephaleuros virescens*), and grey blight (*Pestalozzia Palmarum*), which have been observed on old leaves, the young organs being hardly touched. These parasites can develop on the young organs only in the case of plants already weakened by other diseases; such cases are practically non-existent on the east coast of Sumatra.

Animal pests are only found now and again and do but little damage. In spite of the precautions taken at Java, *Adrama* larvae were found on half-open tea seed imported from Java. It would be well to sort the seed in rooms protected with mosquito netting and to destroy infected seed.

The appearance of *Helopeltis* and *Pachypeltis*, of great importance to the future of tea-growing on the east coast of Sumatra, is more fully discussed. Experiments have shown that *Helopeltis sumatrana*, reported on "gambir" (*Uncaria Gambier*), has a special predilection for this plant, but may also attack tea. Another species of *Helopeltis* was also found on "djamboc" (*Eugenia Jambolana*); so far it is unimportant, but its presence should be noted. It is seen that there are in Sumatra certain species of *Helopeltis* against which growers should take precautions in order to avoid the extensive damage done by them in Java. A species of *Pachypeltis* doing the same damage as *Helopeltis* is also reported.

Growers should not be discouraged but should take steps to control the existing danger at the outset while the chances of success are greatest. *Helopeltis* develops especially on weakened bushes and probably will not invade the plantations of the east coast of Sumatra, where the plants are very strong. Here and there the author found *Brevipalpus obovatus*, which did damage in Java only in plantations above an altitude of 3 280 ft. The plantations of the east coast of Sumatra are less high than this, and it is unlikely that this pest will propagate there. Attacked plants should be removed from the nurseries and destroyed. The paper contains two supplements, one of which gives notes on the Capsidae observed in Sumatra.

267 ***Fomes applanatus*, a Polyporus Attacking Black Ironwood and other Plants, in South Africa.** VAN DER BIJL, P. A., in *The South African Journal of Science*, Vol. XIV, No. 11, pp. 485-492 + 2 Figs. + 1 Plates. Cape Town, 1916.

Fomes applanatus (Pers.) Wallr. (= *F. antralis* Fr.) attacks and destroys black ironwood (*Olea laurifolia*) in the west of the Cape province. It is a facultative parasite entering the wood at ground level through wounds in the bark. The fungus causes de-lignification of the woody tissues followed by a decomposition similar to that caused by *Polyporus lucidus* Lays in the willow. After the death of the tree the fructifications of the fungus continue to form, making it necessary to remove and destroy the dead trunks and branches, which are the seats of infection.

The fungus is described. Besides *O. laurifolia* it is found in S. Africa on *O. juveolata* (bistard ironwood), *Acacia mollissima*, *Melia Azedarach* (syringa), *Rhus laevigata* (red currant), *Curtisia jaginea* (assegai wood), *Trichocladus* sp., *Podocarpus* sp. (yellow wood), *Pyrus communis*, *Celtis Kraussiana* (Camdeboo stinkwood) and *Scolopia Mundtia* (red pear).

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

268 - **The Bean Fly, Injurious to Cultivated Leguminosae in the Philippines.**— OTANES Y QUESALEA, P., in *The Philippine Agriculturist*, Vol. VII, No. 1, pp. 2, 3, 5. Plates. Los Baños, 1918.

INSECTS, I
INJURIO
TO VARI
CROPS

The observations described were carried out at the College of Agriculture of Los Baños, Philippines, on the bean fly (*Agromyza destructor*), described as a new species by J. R. MULLOCK in 1916, from samples obtained at Los Baños. The fly was already known to be injurious to cultivated Leguminosae. So far it is known with certainty to attack cowpea (*Vigna sinensis*), *Phaseolus* spp., and *Dolichos Lablab*.

The nature of the damage done varies according to whether young or ripe plants are attacked. In the first case the adult fly is most abundant when the first leaves of the plant appear. The female lays its eggs in the holes made in the leaves, usually near the base. As soon as they are hatched the larvae bore galleries beneath the skin of the under surface of the leaf, rarely on the upper surface. A few days later the larvae leave the leaves and attack the stem, boring galleries, generally downwards. The attack destroys the tissues, the petioles and other parts of the stem swell and then break. When all the lower part is attacked the plant fades and dies; this occurs also with severely infected petioles.

Before the author's experiments it was believed that the larvae enter the stem near or below the surface of the soil. It was also thought that the eggs were laid on or near the roots and that the larvae killed the plant by attacking its root system. This gave rise to the unsuitable name of "legume root maggot" by which the larva is commonly known.

On ripe plants the attack is limited to the petioles, which swell and break; if the attack is serious the leaves may fade. It sometimes, though rarely, happens that the larvae attack the stem. Even when this does happen the plant does not die, only the parts most severely attacked sometimes swell.

At Los Baños and doubtless throughout the Philippines the insect is the greatest pest of young Leguminosae, sometimes destroying whole fields of them. At Los Baños it attacks by preference the kidney bean and *V. sinensis*, especially from January to the end of April. The Lima bean and "patani", both belonging to the same species (*Ph. lunatus*) are the most resistant plants. Moreover, they are only attacked when the first two leaves appear. "Batao" (*D. Lablab*) and "mungo" (*Ph. Mungo*) are also resistant, but not to the same extent as the Lima bean and "patani". Like these two, they are only attacked when the first two leaves appear. The following Leguminosae appear exempt from all attack: *Psophocarpus tetragonolobus* ("cajumismis"), *Centrosema Plumieri* (*Cana valia ensiformis*), *Cyamopsis psoraleoides* ("guar"), *Stizolobium Iyoni* ("velvet bean"), *Glycine hispida* ("soy bean") and *Cajanus indicus* ("caguios").

A detailed morphological and biological description of the fly is given

The adult is very small, the male being about 1.2 mm. and the female 1.7 mm. long. The life history lasts 21 days, but is slightly longer during the period from December to February, probably as a result of the lower temperature. The female lives a little longer than the male, on an average 38 days, the male living but 37. The female may lay an average of 200 eggs.

A. destructor seems to have two efficient natural enemies in the parasitic hymenoptera *Eurytoma poloni* Girault and *Paratrigenogastera stella* Girault, of which a short description is given. The former seems the more common.

Considering the habits of the larvae it is difficult to control them by spraying, which would probably also be very expensive. Crop rotation and the planting of immune or resistant Leguminosae at the period during which the fly is most active, would doubtless greatly reduce the damage.

269 **Pests of Tea on the East Coast of Sumatra.** - See No. 266 of this Review

270 **The Rose-leaf Hopper, Injurious to Apple Trees in America.** - CHURCH, J., in the *One on Agricultural Experiment Station Bulletin* No. 148, pp. 1-32 + 20 Figs. + 1 Plate + 3 Diagrams. Corvallis, Oregon, 1918.

In 1912-1913 the apple orchards of the north-western Pacific States were badly attacked by the rose leaf hopper (*Empoia rosae*). The attack is limited to the lower surface of the leaves and causes yellow marbling. The insect does not make holes in the fruit but soils it with its excreta.

There are two generations a year. The parasite lives almost exclusively on Rosaceae, showing a marked preference for the rose, which is much damaged by one generation of insects alone. The apple tree and strawberry are the only plants on which both the spring and the summer generation have been observed. The insect's predilection for the rose tree helps in its control. By planting bushes or hedges of roses near, or better still, within, the orchard, the female insects lay nearly all their eggs on the stems of these plants, leaving the apple trees free; it is then easy to destroy a great number before spring. For the control of the hopper are advised:

1) against the first generation, lime sulphur mixture during the first to third pupal stages

2) followed by treatments with concentrated tobacco extract (Black leaf 40) and soap water.

The mixtures must be so applied as to reach well the hoppers on the lower surface of the leaves.

271 ***Halisidota caryae*, a Lepidopteron Injurious to Cultivated Trees in Canada and the United States.** - ISLEY DWIGHT, in U. S. Department of Agriculture Bureau of Entomology, *Bulletin* No. 508, pp. 1-16 + 1 Plate. Washington, D. C., 1918.

The larvae of *Halisidota caryae* Harris (= *Lophocampa caryae* Harris, 1841, *Halesidota annuliflucta* Walker, 1855, *Phegoptera perphyrea* Herrich-Schäffer, 1855, *Halisidota caryae* [Harris] Grote, 1822, *Halisidota caryae* [Harris] Packard, 1890) attack by preference leaves of *Juglans Siebol-*

diana, *J. regia*, *J. nigra*, apple and pear trees; *J. cinerea*, *Cydonia oblonga*, *Carya alba* are also often attacked; the insect has also been reported on species of *Acer*, *Aesculus*, *Alnus*, *Betula*, *Carpinus*, *Castanea*, *Celtis*, *Crataegus*, *Fagus*, *Fraxinus*, *Hamamelis*, *Larix*, *Ostrya*, *Platanus*, *Prunus*, *Quercus*, *Salix*, *Rhus*, *Rosa*, *Rubus*, *Tilia*, *Ulmus*.

In North America this insect is found from the Atlantic westwards to the States of Missouri and Minnesota, as far as Saskatchewan, and from the Canadian provinces of Ontario and Manitoba southward to North Carolina and the south of Ohio.

There is only one generation a year. The insect pupates in autumn and passes the winter in this state. The adults appear at the beginning of the following summer. Laying takes place towards mid-June, the larvae hatching after about a fortnight. The duration of the larval stage varies according to the host; on *J. Sieboldiana* it lasts on an average 74 days, on the pear tree 88, and on the apple tree 92 days.

The only natural enemy of the insect known is *Pimpla pedalis* Cress. As methods of control, in addition to the direct destruction of the eggs and larvae collected on foliage, treatment with lead arseniate towards the end of June, shortly before the hatching of the larvae, may be recommended.

in excellent soil ; its low yield of 7.9 to 9.1 cwt. per acre is due to insufficient cultivation and absence of fertilisers. According to the statistics, Morocco produces 11 000 000 to 13 750 000 bushels of wheat (on 1 509 800 acres) and 16 500 000 to 18 250 000 bushels of barley (on 200 200 acres). The natives also breed oxen, sheep, goats, horses, mules and camels. The census shows 856 000 oxen and 4 000 000 sheep.

The agricultural programme of Morocco has three objects : - 1) to obtain the best results from the acreage under cultivation ; 2) to increase this acreage ; 3) to introduce new crops. Special attention should be given to developing the old crops and new ones grown only with great precautions. Very interesting experiments are in progress, especially with cotton which it seems might be grown in two districts - - the Valley of Schoua and the Marrakech district — if fertilisers were used and the land irrigated.

A study is also made of the mineral wealth of Morocco, among which may be mentioned the calcium phosphate deposits of El Boirondj.

To develop and exploit the resources of Morocco, France must be completely freed from all international, especially German, hindrance. The good results so far obtained have been gained in spite of such hindrance. Peace must also be established throughout the country. Morocco must be supplied with powerful economic assets (roads, railways, ports etc.), and advantage must be taken of the hydraulic resources, which offer great possibilities, though their importance must not be exaggerated. Morocco should be connected with France by a good sea service. French agricultural colonisation must develop so that the natives may be encouraged by the example set.

273 - Economic Development of French West Africa. DYBOWSKI, in the *Bulletin de la Société d'encouragement pour l'Industrie nationale*, Year CXVII, Vol. CXXIX, No. 3, pp. 372-388. Paris, May-June, 1918.

A short historical review is given of the huge colony of French West Africa, originally composed of colonies scattered along the African coast, amalgamated since the decree of October 1, 1902. Under wise administration commercial prosperity has increased rapidly ; general commerce, which in 1891 had a value of 31 million francs, exceeded 300 million in 1916. Though French West Africa receives no grant from France it contributes to the expenses of sovereignty. If France guaranteed the loans, amounting to 246 million francs, used to establish the economic basis of the colony, this guarantee has never taken the form of any kind of grant.

The exports are almost exclusively composed of natural products of the soil or products of native cultivation. An examination of the producing possibilities of these districts shows great promise of prosperity. They may be divided into two classes, 1) the land where exploitation is most rational and which is rich naturally, 2) the land badly exploited or completely abandoned which should be cultivated by new methods (1). The first class includes the methodical exploitation of the forests and of the oil palm.

The forests are a great source of wealth. The amount of timber squared with full edges which 1 hectare (2.471 acres) may supply in the richest

(1) See R. Feb., 1919, No. 146.

parts is estimated at 2820 cubic feet; the average is 1760 cubic feet. There are at least 6 million hectares of forest, so that the huge figure of 10 594 440 000 cubic feet of squared timber may be obtained. This at the price of pine (although it is a question of mahogany and other valuable woods), at least 50 francs per cubic metre (35.31 cubic feet), represents a value of 15 thousand million francs.

The oil palm offers valuable possibilities which might be increased by better exploitation. A thorough study of the question shows there to be 380 million palms from Sierra-Leone to the Congo capable of yielding 1 714 000 metric tons of palm oils and over 171 000 metric tons of "palmiste", representing an annual value of 1 414 275 000 francs.

The Agricultural Service of the colony and the "Association cotonnière coloniale" have shown the possibility of growing cotton by means of irrigation.

It is estimated that there are 8 million head of oxen which might be improved and increased. The Sudan sheep have been improved by crossing with merinos.

The fertile soils of French West Africa will give abundant crops when they have been prepared for cultivation. All the central region so long considered valueless, is in reality full of promise. When the waters of the Senegal and Niger are utilised by means of dams it will be possible to irrigate millions of hectares which, once cultivated, will make these districts incomparably rich.

274 - Economic Development and Agricultural Produce of Madagascar. — YOV, A., in the *Bulletin de la Société d'encouragement pour l'Industrie nationale*, Year CXXVII, Vol. CXXIX, No. 3, pp. 389-415. Paris, May-June, 1918.

The author describes the rapid evolution of Madagascar and its cause — a system of government superior to the Madagascan institutions previous to 1895, an economic legislation in keeping with local possibilities, the creation of means of exploitation which were completely lacking. The commerce of Madagascar which, at the time of the French conquest in 1895, only reached a value of about 10 million francs, has progressed continually till, in 1916, it reached a value of 187 million francs. The increase every five years is shown in the following table : —

	Imports	Exports	Total
			francs
1896	11 000 000	3 500 000	17 500 000
1901	25 700 000	9 000 000	34 500 000
1906	34 000 000	28 500 000	62 500 000
1911	44 000 000	47 500 000	91 500 000
1916	101 955 000	85 000 000	186 955 000

During the last five years trade has, therefore, doubled.

A description is given of the mineral wealth — iron, lead, copper, zinc, cobalt, nickel, silver, gold, coal, lignite, petroleum, bitumen, and graphite.

The products of Madagascar are numerous and varied and correspond to the variations in the climate resulting from the differences in altitude and latitude of the different districts. Crops imported from Europe have been added to the native crops, and both have been developed by improved agricultural methods.

Rice, which is the chief native food, is cultivated in all parts of the island except the extreme south. Dependent on imports in 1900, the colony now supplies the neighbouring countries. In 1916 it exported over 31 000 metric tons of a value of 6 220 000 francs. This figure may be expected to treble in a few years.

Manioc is grown both on the coast and on the table lands above 5 250 feet. In certain districts the yield is $11\frac{1}{4}$ metric tons per acre. The exportation of manioc, which was only 25 metric tons in 1908, was 1500 metric tons in 1916 with a value of $1\frac{1}{2}$ million francs.

Maize, the production of which is about 60 000 metric tons and could be greatly increased, and potatoes, grown in large quantities on the central table land and in the Ankarata range, are very valuable foods increasingly appreciated by the natives. Sweet potatoes are grown over about 158 400 acres and yield an average of 240 000 metric tons.

The cultivation of wheat, introduced by Europeans, developed normally until 1911 on the central table land, but suffered greatly from rust in 1912. Studies and experiments are being made with the object of controlling the disease and acclimatising resistant varieties.

The production of dried vegetables has increased considerably. In 1916 over 14 000 metric tons of a value of $7\frac{1}{2}$ million francs were exported. The vegetables were chiefly kidney beans and lima beans (*Phaseolus lunatus* var. *mammensis*) (1), the yield of which varied from 14.3 to 19.8 cwt. per acre, with a value of 350 to 500 francs per metric ton according to the quality.

Kitchen garden and fruit crops are very abundant, the differences in altitude making it possible to grow infinite varieties (all the fruits of tropical countries and those of temperate countries are grown).

Along the coastal districts, where the climate is tropical, the more costly crops are grown, especially vanilla. Largely cultivated on the east and north west coast with an export which, in 1916, exceeded 216 metric tons of a value of 4 333 000 francs; coffee, chiefly Arabian and Liberian, for which there is a tendency to substitute *Coffea canescens*, an earlier species more resistant to *Hemileia vastatrix*; in 1916, 600 metric tons of coffee were exported; cloves, the exports of which exceed 550 000 lb. with a value of about 500 000 francs, they are now being treated industrially for the local preparation of oil of cloves, cacao (2) and kola, the production of which is recent but may give good results.

Among the industrial crops mention should also be made of coco, all along the coast, but chiefly the north-west; rubber, the production of which

(1) See R. Mouch. 1914, No. 297 and No. 275 of the *Revue (Id.)*

(2) See No. 297 of this *Revue*

is decreasing, tobacco, which is very fine in the mountainous parts of the high table lands, sugar cane, found throughout the island to a height of 4920 feet, essence-yielding plants — vervain, geranium, and chiefly ylang-ylang; a wild textile plant, *Urena lobata*, a bush of the Malvaceae family used by the natives to make very strong rope, fishing nets, and coarse cloths; and fibrous plants, very rich in cellulose, forming an inexhaustible reserve for paper pulp; they are principally bamboo, abaca, vero, zozoro, etc.

Madagascar has immense forests covering from 24 700 000 to 29 640 000 acres, or $\frac{1}{6}$ of its surface; they are mostly in the east and on the heights of the table lands. These forests contain enormous wealth in wood for cabinet-making, marquetry, building and wheelwright's work.

Breeding is on a large scale in the plains of the north, west and south. It is estimated that there are 8 million oxen $\frac{1}{4}$ of which may be slaughtered annually. The preserving factories work regularly. Attempts to transport live stock to Europe have not usually proved successful. Pig breeding and its dependent industries are very important.

The exploitation of this country may be very greatly improved, but an increase in native population should be encouraged and maritime relations with France organised.

275 - The Utilisation of the Lima Kidney Bean (*Phaseolus lunatus*) as a Human Foodstuff. — ROUX, in the *Annales des falsifications et des fraudes*, Year XI, No 127 128, pp 301-306. Paris, November-December, 1918.

The author returns to the often-discussed question of the utilisation of lima kidney bean (*Phaseolus lunatus*) as a human food as he considers the question of poisonous beans more important than ever. After calling to mind the studies, experiments and conclusions of other workers, especially those of Messrs. PRUDHOMME, RIGOTARD and KOHN-ABREST (1), he describes his own experiments and conclusions.

The water in which the beans are soaked for 12 to 24 hours or boiled for 3 hours removes about $\frac{7}{8}$ of the poisonous element from the toxic beans, leaving an average of $\frac{1}{8}$ of prussic acid. In the whole beans the glucoside is far from decomposed after 12 hours soaking, which liberated about $\frac{2}{3}$ of the total hydrocyanic acid. Soaking for 24 hours hydrolyses almost all the glucoside. After 12 hours' soaking, from $\frac{1}{3}$ to $\frac{1}{6}$ of the prussic acid is removed from the whole beans; after maceration during 24 hours this amount is reduced to about $\frac{1}{2}$ of the total acid. At laboratory temperature (13 to 14°C) the action of a certain quantity of emulsine added must last 24 hours to hydrolyse all the glucoside remaining in crushed, boiled beans. Boiling without previous soaking only removes half of the hydrocyanic acid, the other half remaining in the beans.

The author concludes that lima kidney beans, even those containing 30 milligrammes of hydrocyanic acid per 100 grammes of beans, can be safely eaten by adults, on condition that they are first soaked for 12 hours or preferably, 24 hours, in a large quantity of water which is carefully thrown away, the beans being then washed in running water, boiled for three hours

(1) See R. Much, 1918, No 202 (Ed)

bends to the west avoiding nearly all Florida and runs along the Gulf of Mexico between the 20th and 25th N parallels. In the west in territory this curve is much more regular. In the south west of Arizona the first destructive spring frost occurs on an average before March 1st, whereas, towards the north in the interior and in many mountainous districts of the centre and west (2/3 of the total area of the States) this first frost comes after June 1st. The curves corresponding to the date between March 1st and June 1st are greatly influenced by the different latitudes and altitudes.

FIRST AUTUMN FROST. The date in which it occurs on an average before September 1st corresponds roughly with those in which the first spring frost is after June 1st, but is slightly smaller. As a rule the earlier the first autumn frost the later is the first spring frost.

FROST-FREE SEASON. The date from the day of complete absence of frost throughout the year) at Key West, Florida, is less than 90 days in the extreme north and high altitude of the west. The interval which the frost-free season lasts is three months corresponds approximately to that in which the first destructive spring frost occurs after June 1st and the first destructive autumn frost before September 1st. In most cases these districts are covered with vegetation, where the rainfall is sufficient and it is not suitable for agriculture.

278 The Effect of Cold Wind and Rust on Various Wheat, in France

WINTER WINDS. The classification of different varieties of wheat according to their resistance to frost is a very useful and practical meteoric work as it makes it possible to discover rapidly the existing correlations, a knowledge of which greatly facilitates the selection work. Such a classification was made at the Genetic Station of VINCENNES near Paris in 1917 when it froze almost continually from January 2 to February 15 the temperatures sometimes falling to -10°C . This was a severe test of the resistance to cold of the different varieties of winter wheat grown in the experimental plots of the Station. According to the damage done by the frost to the different varieties of wheat of METZ and VINCENNES divided them into 5 classes (1)

- 1) Varieties which resisted well or hardly suffered.
- 2) Varieties which suffered slightly (loss from 1/4 to 1/2 of the plants).
- 3) Varieties which suffered (2/3 of the plants lost).
- 4) Varieties which suffered greatly (loss 1/2 to 1 and 3/4 of the plants).
- 5) Varieties almost completely or completely frost-bitten.

M. PABBE G. VINCENNES who does selection work at Nages, near a high locality (2020 to 2350 ft.) with a climate still somewhat dry well the morphological characters which may be correlated with resistance or sensibility

(1) The letter that follows wheat with 1 to 5 according to the resistance (Jd)

veness to frost, found a marked correlation between the colour of the ear (glumes) and the grain of winter wheats and their resistance to frost. According to him the Mendelian characters red ear and red grain are indices of resistance to frost, whereas the characters white ear and white grain show sensitiveness to frost. This led him to seek in the table of the colour of the ear and grain of the different wheats published by M. GAROFA (1) those wheats contained in M. J. DE VILMORIN's list of the decreasing resistance to frost (2). He thus obtained the following decreasing list of 30 varieties

Colour of grain

1	Rouge d'Altkich	copper red	reddish
2	Leveson	dark red	yellow and reddish
3	Dattel	red	white
4	Autonne rouge barbu	dark brown	red
5	Nonette de L'auzanne	red	red or reddish yellow
6	Epette blanche barbu	white	pale red
8	Victoria d'automne	dark or profuse	reddish yellow
9	Blanc de Flandre	white	white
10	Besstaple	reddish brown	red
12	Gros bleu	white	red
13	Buquet jeune	white	yellow
14	Lained	red	red
15	Rouge d'Espagne	brownish red	red or reddish yellow
16	Browick	red	red
20	Chiddam d'automne	dark red or brown	white
29	Roseau	white	white
30	Bordeaux	reddish or brown	red
31	Bon Fermier	milk white	yellow
32	Japhet	white	red
35	Hittimverdie	white	pale yellow
38	Noe	white	yellowish grey
39	Bordier	white	white
42	Roi de St. Land	white	red
43	Rieti	white	grey
49	Chiddam de mars	white	white
51	Fonzelle rouge de Provence	very dark red	red
54	Ricelle blanche de Naples	white	white
55	Gronde	white	reddish
57	Petanelle blanche	white	white
61	Saumur de mars	white	pale red

By comparing M. VIEOLIS' list with that of M. DE VILMORIN a positive correlation is found between the pigmentation of both the glumes

(1) Cf. GAROFA *C. V. C.* vol. 1 pp. 190-191. Revue agricole publiée sous la direction de G. WERY. Paris. Librairie J. B. Baillière et fils, 1909 (*Id.*)

(2) *Id.* cit.

and the grain and resistance to rust. Of the first 15 varieties on M. VIEULES' list (Nos. 1-20 of M. DE VILMORIN'S) 11 have a more or less red ear and 12 more or less coloured grain. All these 15 varieties are included in DE VILMORIN'S first class (varieties which resisted well) except No. 20. Chiddam d'automne à épi rouge, which is in the second class (varieties which suffered little). These 15 varieties thus make up the group of frost resistant wheats. Of the last 15 varieties (Nos. 29-61), 13 have white ears, and 5 white grain as well. These last 15 varieties are all included in DE VILMORIN'S 3rd, 4th and 5th classes, and make up the group of wheats sensitive to frost.

SPRING WHEAT. - The results obtained at Nages with Aurore wheat show the necessity of knowing the climate and soil well before judging the value of a new variety. The productivity shown by Aurore wheat near Paris was not maintained in Aquitaine and Languedoc, where it also proved very sensitive to rust, especially in the following Tarn districts: - Nages (2 620 ft.), Rayssie de Janes (1960 ft.), Saint-Salvy de Fourrestés (980 ft.), Lauraguais (320 ft.) and Bordelais (130 ft.).

In all these districts Marquis wheat does best. M. VIEULES studied this wheat carefully and used it for creating his Cent Jours wheats (1), keeping it free from all mixture and increasing its earliness by continued selection. At Nages at the present time Marquis wheat is very early, very productive and resistant to rust, lodging, scorching, and frost (red grain); in spite of the violent winds frequent in the locality the grain does not drop. It is above all a spring wheat, but if sown before winter, in the warmer weather, it rapidly ears and ripens, avoiding rust attack by the speed of its growth. It is a wheat capable of adapting itself to very varying climatic conditions, flourishing at altitudes of from 0 to 3930 ft. and in most districts of France - Beauce, Brittany, Anjou, Auvergne, Bearn, Roussillon, Provence, etc.

279 - Injurious Effect of Low Temperature and Mist on the Development of Rice as Connected with the Propagation of Weeds, in the Vercelli District, Piedmont, Italy. MARCARILLI, B., in the *Giornale di Riscoltura*, Year VIII, No. 8, pp. 114-126. Vercelli, August, 1918.

In 1918 much harm was done in the Piedmontese rice fields by the excessive growth of weeds, especially where late varieties of rice, such as "Chinese originario", had been sown and where cold water was used for irrigation (upper Vercelli district). According to the author these unfortunate results were due to the weather conditions. The weather between sowing and complete tillering was abnormal, with frequent low temperatures, continual wet days and cloudy skies, so that the rice began to fail immediately after germination and the first growth of the plants was hindered, to the profit of the weeds.

In rice growing the two most important climatic factors are heat and light (2). The critical periods of rice are those during which it has an ab-

(1) See R Feb. 1918, No. 183. (*Ed.*)

(2) See R May, 1918, No. 502. (*Ed.*)

solute need of a certain minimum quantity of heat and light. If these minimums are not available at these periods the yield will be small even though the temperature be high and the days sunny throughout the rest of the vegetative period. In northern Italy the critical periods are during tillering (more especially when the rice turns yellow before tillering) and during the formation of the panicle. If, at these two stages, the heat is not sufficient to keep the atmosphere of the rice field at a minimum temperature of 13-14°C for the first stage and 15-16°C for the second, according to the variety of rice cultivated, the yield in paddy may be partly compromised.

In 1918, during the tillering stage (from the end of May till about June 20), at which the rice plant supplies the considerable amount of plastic matter necessary to the formation and development of the adventitious roots and secondary stems, the temperature round the rice fields was well below the normal (14°C as compared with 17°C in 1916 and 1917). The result was very weak growth in height and tillering in the late varieties of rice, whereas the weeds, much less exacting in heat and light, developed rapidly and abundantly in the spaces left empty by the scant vegetation of the rice.

From the time of sowing till harvest, weeds always compete strongly with rice with a series of species of increasing harmfulness, such as the late panic races known as "giavone" (*Panicum phyllorizoides* and *P. erectum*) (1), the roots of which benefit greatly by the cultural methods and fertilisers applied to rice. Weeds are, however, yet more harmful by the growth of their aerial parts which deprive the rice of the light and heat of which it has so much need in order to give good yields. This purely vegetative competition gradually decreases the rice yield more and more. This is shown by the author's experiments aiming at determining the relation between the degree of tillering of rice (number of plants divided by number of stems = tillering energy; weight of dry matter) and the degree of infestation by weeds (number of plants and total weight of their dry matter) to the unit of surface. Some of his results are given below :-

1st case : - rice sown on April 26 and never weeded. - On July 10 there was an enormous number of weeds of all kinds and sizes, whereas rice plants were scarce, of limited tillering and low so that the ratio between the dry matter of weeds and that of the rice was very high ($\frac{\text{weeds}}{\text{rice}} = 1.10$), making it possible to foretell a small harvest.

2nd case : - rice sown on April 20 and weeded only once on June 15. - The ratio $\frac{\text{weeds}}{\text{rice}}$ dropped to 0.61.

3rd case : - rice sown on April 12 and weeded twice. - The ratio $\frac{\text{weeds}}{\text{rice}}$ was yet lower : 0.20.

4th case : - rice sown on April 10, transplanted on June 10, never

(1) See R. Dec., 1912, No. 1688 (1a)

weeded. - - The ratio $\frac{\text{weeds}}{100}$ was very low, not exceeding 0.05.

The fact that transplanted rice contains almost no weeds may be explained as follows: - rice plants for transplantation are first grown in well-fertilised soil and receive warmer water. In the soil in which it is transplanted it receives much light and heat, thanks to its spacing (8 times greater than in the nursery), so that as soon as it has taken root (in 4 to 6 days) it develops vigorously and, 15 to 20 days after transplanting, covers the whole of the rice field, suffocating and killing the weeds which have grown.

The causes of the excessive growth of weeds in rice fields being known it is more easy to find methods of prevention. Among these methods are: -

1) Arranging for the critical period to coincide with the most favourable weather conditions, this may be done by delaying sowing so that tillering begins after the end of May. The efficacy of this method is shown by the fact that, in 1918, the rice plants of one variety, sown relatively late, were less infested by weeds.

2) Cultivating early varieties, with a short vegetative cycle, in rice fields irrigated with cold water. If late varieties yield more, the area over which they may be grown is much more limited on account of their heat requirement.

3) Modifying the weather conditions artificially during the critical period by transplanting. Transplanted rice receives more light, as a result of the regular distribution of the plants in the field, and the soil and water are warmer because the water is more exposed to the sunlight and the soil, submerged only in June, at the time of transplanting, has before this period a special physical texture and contains much air which enables it to have a temperature more favourable to the development of adventitious roots (warm soil).

280 Effect of Afforestation on Hidden Condensation. — DESCOMBES, P., in the *Revue Scientifique*, Year LVI, No. 16, pp. 190-197 + Bibliography of 20 Publications. PARIS, 1918.

The author insists on the importance of afforestation to regulate the discharge of waters and its influence on the quantity of the waters by decreasing their absorption and increasing the quantity deposited on the soil by meteorological factors. Afforestation, moreover, largely increases hidden condensation, i. e. dew, mist, hoar frost which, though not registered by the rain gauge, are as important as rain. This was shown by F. A. FORNI for the Lake of Geneva which discharges more water than it receives from rain and snow; this has also been shown for other water basins.

As evaporation (which alone causes more than half the rain water to disappear) must also be taken into account, it must be admitted that the supplementary water received by a basin comes from another source and that it forms more than half the water discharged from the basin. The only known source of such water is hidden condensation. Though it is not yet possible to estimate the exact extent to which afforestation increases such

condensation, a relative idea of it may nevertheless be formed by comparing the large amount of rime on a tree after certain winter nights with the minute amount of dew covering the bare soil near on a surface equal to its horizontal projection.

Conclusive results obtained by various scientific societies and workers are given. These results confirm the theory sufficiently to make it certain that, by planting trees on land above torrents the hidden condensation will be at least doubled. The water received by each basin would thus be increased by 50 % in addition to 10 % due to the increased rainfall in wooded land, so that the total increase would be 60 %. Therefore, by planting woods on $\frac{1}{3}$ of the land of each basin, so as to leave pasture land for cattle, its value would be increased by 20 %.

Attention is drawn to the special conditions of recent years by which certain countries have been obliged to sacrifice a great part of their forests and to rely on imported timber. This should be remedied as soon as possible and re-afforestation started seriously.

251 - **The Influence of Plant Residues on Nitrogen Fixation and on Losses of Nitrate in the Soil.** - HURCHINSON, M. B., in *The Journal of Agricultural Science*, V 1 IX, Pt 1, pp 92-111 + 5 Tables + 3 Figs. + Bibliography of 23 Publications. Cambridge, August, 1918

SOIL PHYSICS
AND
MICROBIOLOGY

The remains of plants mixed with the soil undergo many changes, each of which tends to predominate according to the different environmental conditions - aeration, moisture, temperature, and soil reaction. The accepted theory, according to which the importance of the organic matter added to the soil lies in the humus it forms, does not fully explain the part played by plant remains, because the initial and intermediate stages of their decomposition are probably equally important as regards the fertility of the soil.

To solve this problem the author made laboratory, pot and field experiments by which he sought to determine the effect of carbohydrates (sugar and starch) and plant detritus as sources of energy in the fixation of atmospheric nitrogen by *Azotobacter*.

RESULTS. -- Plant detritus mixed with the soil caused an increase in the fixation of nitrogen in the soil; in the laboratory experiments this increase was 6 mgm., and in the pot experiments 9 mgm. of nitrogen per gramme of detritus added. When 1 ton of sugar per acre were applied in the field the increases in yield, attributable to nitrogen fixation, were from 20 to 54 %.

As the action of sugar and that of plant remains differ only in intensity and not in nature, it would seem that complex organic matter, such as stubble, dead leaves, etc., may also increase indirectly the nitrogen content of the soil.

For soil to favour nitrogen fixation it must have, in addition to a source of energy for the fixation bacteria, a suitable temperature, phosphates, and some basic matter, such as calcium carbonate. Nevertheless, even under the conditions most favourable to nitrogen fixation, there occur

periods when it is hindered by certain processes which must be allowed to pass before cultivating a crop. Under unfavourable conditions, especially in cold weather, these processes may continue as to prevent all increase of nitrogen in the soil.

The addition of carbohydrates (starch, sugar), or plant remains (straw, hay, etc.), to the soil, may cause denitrification for a certain time, after which nitrification begins.

282 - The Influence of Cocci on Nitrification in the Indian Alluvium. — SEN, J. N., in the *Journal of Agricultural Science*, Vol. IX, Pt. 1, pp. 32-42 + 4 figs., Cambridge, August, 1918.

Nitrogen is one of the most important foods of plants. It occurs in the soil in an organic form, but, to be utilised it must first be changed into nitric nitrogen. The necessary decomposition of organic matter depends on many factors, one of the most important of which is a sufficient supply of air. Large quantities of oxygen are used in decomposition reactions, so that the better the soil is aerated, the more efficient is the decomposition of the organic matter and, consequently, nitrification. The amount of oxygen available also depends on the activity of the soil fungi which make the phosphates and potassium assimilable by higher plants, and it is herein that the importance of cocci as aerating agents lies.

The author made a series of pot and lysimeter experiments on this subject. The results showed that the addition of 30 % of cocci to the soil causes a marked increase in the nitrates in the drainage waters. There is also a connection between the development of the plants and the nitrification in the soil caused by the addition of cocci.

283 - Reduction of Nitrates in Soil to which Organic Matter Has Not Been Added. — OELSNER, A., in the *Centralblatt für Bakteriologie, Parasitenkunde, und Infektionskrankheiten*, II Abt., Vol. XLVIII, No. 10-11, pp. 210-221, Jena, 1928.

Reduction of nitrogen may occur in sufficiently moist soil (40 % of water) although it has not received carbon-containing matter as a source of energy for the denitrifying bacteria. The author attributes this to insufficient aeration which causes the soil bacteria to reduce the nitric nitrogen. He does, however, admit that the presence of a layer of water capable of surrounding the soil particles causes the formation of anaerobic conditions under which the denitrifying bacteria, finding complete freedom of action, may reduce the nitrates to elementary nitrogen even though the soil be very poor in organic matter.

This shows that reductions of nitrogen, hitherto attributed to the presence of a large quantity of cellulose (straw and similar matter) may occur in the soil whenever aeration is inadequate even though there be no abundance of such matter.

284 - Comparative Study of Methodes for Determining the Acidity of Soil. — SEPPARSON, R. E., in *Soil Science*, Vol. VI, No. 1, pp. 33-52 + Bibliography of 10 publications. Baltimore, July, 1928.

In order to prove whether the methods at present in use determine exactly the total acidity of the soil, the author made a comparative study

of the methods of HOPKINS, VEITCH, JONES, MAC INTIRE, TRUOG and TACKE. He concluded that TACKE's method is the most satisfactory. This method is based on the use of pure water and calcium carbonate, and the determination of the acidity by the carbon dioxide given off. Taking 100 as the standard of the results obtained by TACKE's method for the acidity of two silt loams (one light, the other dark), the author obtained the following figures by the other methods: HOPKINS 46.5 and 36.9; JONES 89.7 and 74.2; MAC INTIRE 85.4 and 62.6; VEITCH 108.1 and 97.4; TRUOG 283.7 and 245.2.

The pure water used in TACKE's method is a good medium for the reaction between an acid soil and calcium carbonate although this reaction is hastened somewhat by the use of dilute solutions of calcium or sodium chloride. Concentrated solutions of these chlorides retard the reaction. The presence of disinfectants, such as toluene, is unnecessary.

The most important conditions for obtaining good results by TACKE's method are: — the duration of the reaction, which should not last less than 5 to 10 hours; aeration, which must be kept at its maximum rate; vigorous shaking. Under these conditions the method gives consistent results with respect to the total acidity and, to a certain extent, the toxicity of the acid soils. It is to be hoped that subsequent experiments will make it possible to determine more exactly the duration of the reaction as it is on this that the qualitative and quantitative exactness of the method depends.

285 — **Preliminary Report on an Experimental Drain in Alkaline Soil in Fresno County, California, U. S. A.** WLEB, W.W., in the *University of California Publications, College of Agriculture, Agricultural Experiment Station, Bulletin, No. 211*, pp. 103-123; + 11 Figs. Berkeley, November, 1916

TILLAGE &
METHODS
CULTIVATION

This report, drawn up in collaboration with the Office of Public Roads and Rural Engineering of the U. S. Department of Agriculture, deals with the drainage of alkaline sandy loams, previously planted to vines. In the surface layer, 1 foot deep, the salt content (carbonate and particularly sodium chloride) varied from 0.2 % in most of the soil, to 3 % in small parts of it. Observations made in 1912 and the beginning of 1913 showed that at no time of the year was the water table lower than 7 ½ ft. below the surface of the soil, and in June it was within 2 ft. Throughout the vegetative period the water table did not reach a depth of 6 ft. and for 4 ½ months was above 4 ft. The area drained was 151 acres.

The drainage system, made entirely of earthenware pipes, included:

a) a main drain with a successive diameter of 6, 8, and 12 inches; b) a system of lateral pipes 6 inches in diameter. The main drain was placed at an average depth of 7 ft. and had a fall of 1 in 1000. The lateral pipes, placed 8 to the east and 9 to the west of the main drain were at an average depth of 5 ¾ ft. and 3½ ft. apart. The total cost of the drainage was \$100 per acre. Measurements of the amount of water discharged by the pump, show that, under similar conditions, pipe drainage must be built so as to evacuate at least 1 cubic foot per 100 acres per second especially when the drained land is entirely surrounded by undrained land. It was also found

that the lateral pipes should have been 400 ft. apart and would have been better at a greater depth (6 $\frac{1}{2}$ or 7 ft.).

Hardpan, which was found to be present, did not greatly hinder the movement of the water. Two years of flood irrigation sufficed to reduce the quantity of alkali sufficiently to make it harmless to plants. Although the sodium chloride content was originally 2 $\frac{1}{2}$ times greater than that of the sodium carbonate in the surface foot of soil, the chloride was carried away much more easily than the carbonate. Although at the end of the second year the carbonate had decreased by 15 %, it still exceeded the chloride by 5 % (at the surface foot always).

Progressive accumulation of alkali has spoiled the land planted to vine (in 1889), and later to alfalfa, grain, and, finally poor pasture (and, in places, bare soil), drainage followed by flooding transformed it into good soil which, in 1916, yielded 180 tons of cereal hay, or 1.2 tons per acre.

**MANURES
AND MANURING**

256 **Liming the Soil.** - SHOOKY, L. C., in the *U. S. Department of Agriculture, Farmers' Bulletin*, No. 911, pp. 1-6 Feb. 1916, Washington, March 1916.

This bulletin contains information for practical farmers on the materials used for liming soil and their preparation, and discusses the reactions brought about in the soil by lime. The merits of the different forms of lime as soil fertilizers and the factors determining their choice are discussed in full. An appendix gives and explains a list of the scientific terms most commonly used in liming.

287 **Water Holding Capacities of Material for Live Stock, Amounts Required to Bed Animals, and Amounts of Manure Saved by their Use.** - WISEMAN, J. W., in the *Journal of the National Research Council*, Vol. XIV, No. 3, pp. 1-20, 13 Tables, Bibliography of 10 References, Washington, 1916.

For 25 years agricultural literature has repeated the erroneous conclusions as to the relative value of sawdust, wood shavings, and different straws as litter. The conclusions are based on the capacity of the material to absorb the different liquids with which it is soaked, published in 1893 by HILBERT and reproduced by DEMLER in his "*Traité de culture agricole*" (2nd. Ed., § 283, Paris, 1912).

The author's experiments have shown that 100 lb. of oat straw holds, in 24 hours, 250 lb. of water. Making this absorbant power equal to 100, the figures for the absorbant power of other material are: wheat straw, 81; fine dry Weymouth pine (*Pinus Strobus*) shavings, 74; mixed sawdust 64; mixed shavings 52-47. It is seen that oat straw holds about twice as much water as shavings and 15 to 20 % more than wheat straw.

About 40 to 82 % more shavings than oat straw and 9 to 18 % more wheat straw are needed to make up the litter.

The amount of excreta retained by the litter which may be used as manure varies little whichever material is used.

288 **Green Manure for Rice Fields, in the Kandy District, Ceylon** - MORGAN, W., in the *Tropical Agriculturist, Journal of the Ceylon Agricultural Society* Vol. LI, No. 6, p. 309, Peradeniya, 1916.

The use of green manure in rice growing, so common in India, has not

developed in Ceylon, although the Agricultural Society of Ceylon has shown the excellent results obtained with it in a series of carefully conducted experiments. The results obtained in the Kandy district, especially at Harispattu, Yatinuwara and Udunuwara are conclusive. Plants, the leaves and twigs of which make good green manure are, in order of importance: -- "Kekuna" (*Canarium zeylanicum*), "Dadap" (*Frythrinia lithosperma*) "Kappitiya" (*Croton lacciferus*), "Karanda" (*Pongamia glabra*). "Adathoda" (*Adhatoda Vasica*), "Nawa" (*Sterculia Balanghas*), "Hanapatu" (*Eurcræa gigantea*).

Kandy growers know the value of green manure but do not apply it in sufficiently large quantities to obtain the best results. Most of the trees and plants mentioned above are common in the villages, but their application as green manure and even their value vary with the ease with which they may be obtained and transported.

Special attention is drawn to Sunn hemp (*Crotalaria juncea*), tested by the Agricultural Society. It gave increases in the yield of rice which varied from 27 to 50 % according to the centre in which the tests were made. In the south of India the use of Sunn hemp as a green manure has increased the rice yield by 70 %. It is recommended for the following reasons: - - 1) It is easily grown and may be sown directly in the rice field when the rice is harvested without any preparation, though it is best to plough the soil and prepare it before sowing; 2) it is ready for cutting in 60 to 80 days. The fields are usually left fallow for 2 to 4 months, if Sunn hemp is sown after the first rice harvest ("Maha") the green manure can be dug in 2 or 3 weeks before preparing for the second rice crop ("Yala"). If the Maha crop is cut, as it usually is in Kandy, in the middle of March and Sunn hemp sown immediately, it may be left till the middle of May or June, when the Yala crop starts. The cost of growing this green manure is negligible when the soil is not previously prepared, but even were it to involve some expense, it would be well worth it on account of the good results obtained.

289 - **Use of Green Manure in New Jersey, U. S. A.** - DICKER, J. B. R., in the *New Jersey Agricultural Experiment Station Circular No. 5*, pp. New Brunswick, July 9, 1917.

This circular recommends the use of Leguminosae as green manure as a partial substitute for expensive nitrogenous manures. By ploughing in a good leguminous crop containing 2 % of nitrogen enough nitrogen is obtained for potatoes or other forced vegetables. Cereals given green manure need little or no other mineral fertiliser except superphosphates. Directions on the growing of crops for green manure in New Jersey are given.

290 - **Pot Experiments on the Assimilability of the Phosphoric Acid of Mineral Phosphates, in the U. S. A.** FRAPS, G. S., in the *Texas Agricultural Experiment Station Bulletin, No. 21*, 30 pp. College Station, Brazo County, Texas, January, 1917.

The pot experiments described were made to compare the quantity of phosphoric acid assimilated by plants from superphosphate and mineral phosphate respectively, and to determine the influence of manure on this assimilation. The average amount of phosphoric acid recovered in 25 pot experiments with different successive crops was 48.2 ± 2.2 %.

The average amount recovered, in 22 experiments, by the first crop, was 30.6 % as compared with 47.3 % for all the following crops. The average quantity of phosphoric acid recovered from manure in 22 experiments was 39.2 % as compared with 37.9 % recovered from superphosphate in the same series. Manure probably made some of the phosphoric acid in the soil assimilable. The average percentage of phosphoric acid recovered from superphosphate was less when it was applied with manure than when it was applied alone, because, in some tests, the amount supplied exceeded the requirements of the plant. The average quantity of phosphoric acid recovered from mineral phosphate in 21 experiments was 9.1 ± 1.1 % as compared with 13.9 ± 2.30 % for superphosphate in the same series. The assimilability of the phosphoric acid of mineral phosphate was, therefore, about $\frac{1}{5}$ of that of the superphosphate in the tests with different successive crops.

The value of mineral phosphate varies greatly for different soils. If the first crop only be considered the assimilability of the phosphoric acid of superphosphate is about 6 times greater than that of mineral phosphate. In 19 pot experiments 9.6 ± 1.3 % of the phosphoric acid of the mineral phosphate was recovered when it was applied alone, and 8.6 ± 1.2 % when it was applied with manure (deducting the phosphoric acid recovered from the manure). In the author's experiments manure had no effect on the assimilability of the phosphoric acid of the mineral phosphate.

291 The Influence of Ammonium Sulphate on the Germination and the Growth of Barley in Sand and Soil Cultures Kept at Different Moisture Contents and at Various Osmotic Concentrations of the Soil Solution. — WOLKOFF, M. J., in *Soil Science*, Vol. V, No. 6, pp. 421-479 + 6 Figs. + Bibliography of 270 Publications. Baltimore, June, 1918.

The aim of the author was to determine the optimum conditions of the action of ammonium sulphate as a nitrogenous fertiliser. After reviewing 270 publications on this subject he describes his own experiments made, 1) to determine the relation between the moisture content of the soil and the effects of ammonium sulphate on the germination and development of barley; 2) to determine in what way the plant reacts to the application of nutrient elements, necessary or not to its development, when the moisture of the soil varies between the limits normally found in the field.

The barley was grown in two sets of pots containing sand and sandy loam respectively; both kinds of soil were kept at a moisture content corresponding to 20, 40, 60, and 80 % of the maximum water holding capacity (as well as 10 and 15 % in the germination tests). As fertilisers, different proportions were used of ammonium sulphate, mono-potassium phosphate, magnesium sulphate, ferrous sulphate solution, and calcium carbonate mixed with the soil in the pots. A study was also made of the effect of different quantities of potassium chloride, sodium chloride, sodium nitrate, calcium sulphate, aluminium sulphate, and sodium silicate, when mixed with the other fertilisers. The osmotic concentration of the nutrient solutions was determined before and after they were added to the soil.

RESULTS. — The moisture content of the culture medium had a marked

influence on the development of the plants. Growth was weak when the moisture content corresponded to 20 % of the maximum water holding capacity. After 20 % an increase in the moisture content up to a certain optimum caused a proportionate increase in the dry matter of the plants grown. For crops grown in sand this optimum was 80 %, for those grown in sandy clay 60 %. Above this optimum any further addition of water caused a decrease in the yield in dry matter.

When the moisture content was constant, increasing the amount of ammonium sulphate, calcium carbonate, and mono-potassium phosphate caused a proportionate increase in the yield in dry matter of plants grown in sand (these three salts are given in the order of their efficacy). In plants grown in sandy loam the effect of ammonium sulphate was similar, but that of mono-potassium phosphate was very slight, and that of calcium carbonate absolutely nil.

The differences in the development of the plants at the various moisture contents of the culture medium must be attributed to two factors:—*a*) different concentration of the soil solution; *b*) different aeration of the soil.

After a normal application of nutrient salts the concentration of the soil solution is not strong enough to influence the development of the plants when the moisture content of the soil is optimum (about 60 % of the saturation). It only becomes an important factor when this moisture content is considerably lower (40 % and less).

At the end of the vegetative period (30 days) the concentration of the soil solution was less than at the beginning of the experiment. This decrease was greater in the sand than in the sandy loam, and was more marked in the slightly wet culture media (both sand and soil) than in the very wet ones.

In crops grown in sand with 60 % of moisture the effect of a nutrient solution containing (for 2 kgm. of moist sand) 0.4 gm. of ammonium sulphate, 0.8 gm. of mono-potassium phosphate, 2.0 gm. of calcium carbonate, 0.2 gm. of magnesium sulphate, and 0.05 gm. of ferrous sulphate, was increased by a further application of magnesium sulphate and ferrous sulphate, as well as by small quantities of potassium and sodium chloride, sodium nitrate, calcium sulphate and sodium silicate. The beneficial effect of these salts on vegetation may, perhaps, be attributed to an improvement in the equilibrium of the ions of the salts in the soil solution. Under similar conditions aluminium sulphate is injurious to the plants.

The stiffness of the straw was modified by various salts added to the solution. As suitable equilibrium of the soil solution is essential to obtain a stiff straw, this shows that a tendency to lodge produced by an excess of nitrogenous manure may be controlled by modifying the ratio between the salts of the nutrient solution, especially in crops grown in sand.

In a general way the germination of barley grain is influenced by the same factors as the subsequent development of the plant, but to a different degree. In sand barley germinated with both 10 % and 80 % of

moisture. In four different soils, however, germination did not occur below 20 % of moisture, and was delayed above 80 %.

Treating the sand or soil with a nutrient solution had little or no effect on germination when the moisture content was high, but in proportion as this content decreased germination was more and more delayed. This leads to a practical observation : - when the fertilisers applied to barley are well mixed with the soil they are not detrimental to germination ; when, however, the fertilisers are applied in drills at the same time as the seeds the soil solution immediately surrounding them may become very concentrated and, consequently, detrimental to germination, especially if this takes place during dry weather.

292 - Analyses of Chemical Fertilisers, Bone Powders, Lime for Fertilisers, etc., in New Jersey, U. S. A., in 1916. - CHANCE, C. S. etc., in: 1. *New Jersey Agricultural Station, Bulletin No. 297*, pp. 3-13. - 11. *IBID. Bulletin No. 303*, pp. 5-52. New Brunswick, 1916.

The first bulletin gives the results of analyses of 635 samples of chemical and other fertilisers collected for examination in 1916 in New Jersey.

The second bulletin, a supplement to the first gives : a) the results of analyses of 283 samples of commercial fertilisers, 43 samples of bone powders, and 5 samples of lime for fertilising purposes, collected at the same time as the first set of samples ; b) a list of trade marks of the fertilisers put on the market in New Jersey State.

293 - Commercial Fertilisers in Texas, U. S. A., in 1916-1917. - FRAPS, G. S., in the *Texas Agricultural Experiment Station Bulletin No. 217*, 26 pp. College Station, Brazos County, September, 1917.

The results are given of analyses of commercial fertilisers made at the Texas Agricultural Experiment Station in 1916-1917. A list of trade marks registered during the same period is also given.

The results of numerous analyses of Texas soils, and pot and field experiments, show that many soils supply the plants (maize and cotton especially) with enough potassium for them to do without potassic fertilisers much more easily than without phosphatic or nitrogenous fertilisers. The economy in potassic fertilisers is justified by the high prices asked for them in 1916-1917.

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

294 - Experiments in the Acclimatisation of Palms in the Island of Elba, Italy. - ROSSIER, G., in *L'Espresso Coloniale*, Year XII, No. 4, pp. 27-28, Florence, 1918.

The author gives the principles on which the acclimatisation of tropical plants in temperate districts should be based and describes the results of his numerous experiments and observations on the acclimatisation of palm trees at Ottonella, Island of Elba.

CHOICE OF SPECIES. When a tropical plant is to be acclimatised in a temperate district it is first of all necessary to determine as exactly as possible the climatic conditions of the plant's native country and the extent to which the plant is capable of modifying its structure so as to live under weather conditions differing more or less from those of its natural habitat.

Nothing has been so detrimental to acclimatisation tests as the wrong idea that all plants from tropical countries must be kept in hot, moist glass-houses.

If the Palm family be considered it is found that several warm country species live in the mountains, and it is this which has made it possible to grow them in the Mediterranean district. The following species may be specially mentioned :—

Arenga saccharifera, flourishing at 1 600 to 1 980 ft., in the Indian Archipelago ;

Kentiopsis marcocarpa between 1 980 and 3 300 ft., in New Caledonia ;

Sabal umbraculifera, at 3 300 ft., in the Antilles ;

Phoenix humilis and *P. acaulis* at 3 900 ft., in the Khasia mountains ;

Trachycarpus Martianus, at 6 500 ft., and *T. Takil*, between 6 500 and 7 800 ft on the Himalayas ;

Ceroxylon andicolum, between 8 125 and 9 800 ft., in the Andes.

It is not necessary to keep any of these species in glasshouses and all of them can withstand even very low temperatures without suffering any injury

Many palms usually kept in glasshouses do very well in the open in Elba and, in 1901, withstood perfectly well a temperature of -2.9°C . Among these may be mentioned specially *Chamaedorea elegans* Mart., *C. desmoncoides* Wendl., *C. Sartorii* Liebm., *C. Corallina* Hook f., *C. Ernesti-Augusti* Wendl., *C. concolor* Mart., *C. oblongata* Mart., *Archontophoenix Cunninghamii* Wendl., *Cocos Weddelliana* Wendl., and *Phoenix Roebelinii* O'Brien.

Many tropical plants can withstand much greater daily variations in temperature than would be supposed. At Ottonella, on March 12, 1915, a thermometer placed 50 centimetres above the soil near two Cycadaceae (*Encephalartos Allensteinii* and *Lepidozamia Peroffskyana*) showed, in 24 hours, first a minimum of -4°C , then, in the afternoon (under the combined action of the sun and the heat reflected by the soil) a maximum of $+30.8^{\circ}\text{C}$; the two palms did not suffer at all from this variation of $+34.8^{\circ}$. These examples show that a careful study of the real climatic requirements of a tropical plant in its native habitat may greatly facilitate and simplify acclimatisation work.

CHOICE OF SOIL, AND EXPOSURE. — Palms usually prefer sandy soil and should not be planted in calcareous soil. Most of them are heliophilous, i. e., they prefer open, sunny positions. Exceptions to this general rule are : — a) certain short-stemmed species which prefer shade and live under trees, such as *Bacularia monostachya*, *Cocos Weddelliana*, *Raphis* spp.; b) other species which prefer to be partly shaded, such as those of the genera *Howea*, *Archontophoenix*, *Khoplostylis*, *Hedyscepe*, *Kentiopsis* and *Ptychosperma*. Under high trees these plants are protected not only against the excessive heat of the sun but also against cooling off as a result of soil radiation in the early morning.

PREPARATION OF THE SOIL. — To plant a palm a wide ditch, about 1 metre deep, should be dug and filled with a mixture of 2 to 3 parts of good

soil, 1 part of sand and 2 to 3 parts of mould. The addition of mould is very important and has the following effects: —

- 1) Increase of the minimum daily temperatures (1.6°C as monthly average of 1070 observations, but often reaching 2° , rarely 4°);
- 2) Decrease of maximum daily temperatures;
- 3) A resultant decrease in the daily temperature variation, thus making the thermic condition of the soil more uniform; the monthly average of 1070 observations showed this decrease to be about 2°C , but it is often 3° and occasionally 4.8° and 5.1° .

By careful choice of site and soil and suitable preparation of the soil the author has successfully grown fine, strong specimens of numerous species of palms in the open air and exposed, without any protection, to the severities of winter.

295 - Root Tropism Caused by the Application of Carbonic Acid to the Soil. - NOYES, H. A., TORST, J. P. and YODER, L. in *The Botanical Gazette*, Vol. LXXVI, No. 4, pp. 364-373 + 9 Figs. Chicago, October, 1918.

It is well known that gas may cause tropism of the roots. The authors found tropism caused by carbonic acid during an experiment on the action of this gas on plants grown in paraffined Wagner pots, through the soil of which a constant or intermittent (8 hours a day) stream of carbonic acid passed from top to bottom (1)

The plants tested, dwarf pepper (*Capsicum annuum* var. *abbreviatum*) lettuce (*Lactuca sativa*), radish (*Raphanus sativus*) and kidney bean (*Phaseolus vulgaris*) were affected by the carbonic gas in different ways. The development of the roots was much more affected than that of the aerial parts, according to the plant. In pepper, lettuce and radish treated with the gas root growth decreased, whereas in kidney beans it increased. The effects of constant or intermittent currents on the roots of the various plants also differed. In kidney beans the intermittent current appeared to be the optimum for root growth, for, as a rule, a constant current of 650 cc. of carbonic acid per hour tended to inhibit the normal development of the root system.

It is generally admitted that the decomposition of organic matter in the soil favours plant growth, but cases are quoted in which large quantities of green plants dug in have temporarily injured the soil and, consequently, vegetation. This fact, together with the results obtained by the authors, makes it seem that the high carbonic acid content of garden soil may sometimes be injurious to the root development of the plants cultivated, and that the aeration of the soil is no less important to this development than water and temperature.

296 - Mineral Matter Extracted from the Soil by Young Rice Plants; Investigations in the Dutch Indies. — VAN ROSSEM, C., and WIEBER, F. W. in *Teysmannia*, Year XXIX, No. 6, pp. 311-315 + 5 Tables. Batavia, 1918.

The investigations described were carried out at the Agricultural Chemistry Laboratory of the Dutch Indies to determine the mineral composition

(1) For similar experiments, see *R.*, Jan. 1919, Nos. 10-13. (Ed.)

of rice seed and, after germination, of the seedlings springing from them. It was found that 100 rice seeds and 100 seedlings contained respectively — Nitrogen, 0.027 gm. and 0.049 gm. ; silica 0.095 gm. and 0.534 gm. ferric oxide 0.001 gm. and 0.124 gm. ; calcium 0.001 gm. and 0.019 gm. magnesia 0.005 gm. and 0.015 gm. ; potassium 0.005 gm. and 0.104 gm. sodium 0.002 gm. and 0.013 gm. ; phosphoric acid 0.012 gm. and 0.027 gm. ; chlorine 0.033 gm. and 0.004 gm. ; sulphuric acid 0.009 gm. and 0.051 gm.

These results show that during the first forty days after germination 100 rice seedlings extracted from the soil : — Nitrogen 0.022 gm. ; ferric oxide 0.123 gm. ; calcium 0.018 gm. ; magnesia 0.010 gm. ; potassium 0.099 gm. ; phosphoric acid 0.015 gm. ; sulphuric acid 0.012 gm.

297 - **Comparison Between the Salt Requirements of Buckwheat Plants During the First and Last Stages of Their Development in Solution Cultures and Sand Cultures.** - I SHIVE, J W and MARTIN, W H, A Comparative Study of Salt Requirements for Young and for Mature Buckwheat Plants in Solution Cultures, in the *Journal of Agricultural Research* Vol XIV, No. 4, pp 151-175 + 3 Figs. + Bibliography of 8 Publications. Washington, July 22 1918. II SHIVE, J W, A Comparative Study of Salt Requirements for Young and Mature Buckwheat Plants in Soil Cultures, in *Soil Science*, Vol VI, No. 1 pp 1-32 + 3 Figs. + Bibliography of 10 Publications. Baltimore, July, 1918.

I. -- SOLUTION CULTURES. -- It is of value to know where there are differences between salt solutions capable of assuring the optimum development of young buckwheat plants and what are the solutions procuring this optimum for plants in the ripening stage. To solve this problem the authors compared the salt requirement at the beginning and end of the growing period of buckwheat plants of the Japanese variety grown in nutrient solutions. These solutions all had the same initial osmotic concentration of 1.75 atmospheres, but differed in the proportion of dissolved salt (potassium phosphate, calcium nitrate, magnesium sulphate, traces of ferric phosphate). In all there were 36 solutions each containing different proportions of salts.

Results. -- During the first four weeks after germination the greatest production of roots and aerial parts was made by plants grown in a solution containing the following number of gram molecules per litre : — potassium phosphate 0.0144 ; calcium nitrate 0.0052 ; magnesium sulphate 0.0200.

During the four weeks taken by the seed to form and ripen, the greatest yield was obtained from plants grown in a solution containing : — potassium phosphate 0.0108 ; calcium nitrate 0.0130 ; magnesium sulphate 0.0100.

During each of these stages the quantity of aerial parts produced was, in general, proportionate to the amount of water transpired by the plant.

In both stages the value of the ratios $\frac{\text{magnesium}}{\text{calcium}}$ and $\frac{\text{magnesium}}{\text{potassium}}$ and $\frac{\text{calcium}}{\text{potassium}}$ characteristic of the most and least productive solutions differed greatly.

During the last stage of growth the buckwheat plants reacted to the changes in the amount of salt in the solutions as quickly as in the first stage, but to a very different degree.

II. — SAND CULTURES — The same 36 solutions were used as for the solution cultures. The results obtained were similar to the preceding ones and showed that the physiological properties of these solutions with respect to plants do not change when applied to sand cultures.

As a rule high yields in roots and aerial parts corresponded to relatively low values for the ratios $\frac{\text{magnesium}}{\text{calcium}}$, $\frac{\text{calcium}}{\text{potassium}}$ and $\frac{\text{nitrogen}}{\text{potassium}}$.

298 **A Physiological Study of the Sulphur Requirement of Purple Clover.** TORRINGHAM, W. F. in *The Journal of Biological Chemistry*, Vol. XXXVI, No. 2, pp. 1013-1018, 1918.

To determine the specific action of sulphur on purple clover (*Trifolium pratense*) the author made experiments with water and sand cultures which made it possible to make the artificial modifications more sensitive than is possible with field tests or ordinary pot experiments. For the water cultures he used a 2% concentration of KNOP's nutrient liquid, and for the sand cultures, a fine, sifted sand. When the plants were approximately ripe they were harvested, the roots and upper parts separated, dried at about 100°C., and weighed.

CONCLUSIONS. — In water cultures $\frac{9}{10}$ of the normal quantity of magnesium sulphate may be replaced by magnesium nitrate without modifying the growth of purple clover appreciably. In sand cultures substituting $\frac{99}{100}$ of the magnesium sulphate causes a considerable decrease in the yield of dry matter in the stems and leaves. In both cultures total substitution of the magnesium sulphate causes a decrease of 33 to 49% in the yield of dry matter of the epigeal part. The addition of sulphur to the KNOP solution previously modified to free it from sulphur, causes more intense growth of the epigeal part, a growth superior to that caused by normal KNOP solution. Control cultures with sodium nitrate and calcium nitrate showed that this favourable effect cannot be attributed to the action of the cations of these sulphates. The effect on the roots varies greatly according to the crop. The quantity of nitrogen absorbed by these crops varies more or less evenly with the variations in the yield of dry matter of the epigeal part; both the nitrogen content and yield in dry matter become less as the quantity of sulphur supplied decreases. It seems, therefore, that absence of sulphur restricts the synthesis of the protein and the elaboration of the tissues of the plant organism.

Taken as a whole the results of these experiments show the superiority of sodium and calcium sulphates over magnesium sulphate as a source of sulphur for clover in water and sand cultures. This may be connected with the well-known toxic properties of magnesium salts. Calcium sulphate is the most satisfactory source of sulphur, and the author's experiments show the peculiar efficacy of this sulphate to be due to its complex molecular action.

- 299 - **The Physical Factors of Transpiration in Plants and of Transpiration of Parasitised Leaves.** -- DUFRENOY, J., in the *Revue Générale des Sciences*, Year XXIX, No. 20, pp. 565-566. Paris, October, 1918

In numerous experiments on leaf transpiration the plant has been associated with physical system by comparing its transpiration to the evaporation of water by a porous surface (BRIGGS and SHANTZ) (1); in addition to the physical factors dependant on the transpiring membranes, physiological factors, as yet little known, are concerned. In light, transpiration is closely connected with the pigments. Chlorophyll seems to play a particular part; the green parts of leaves transpire more than yellow parts caused by variegation or the discoloured parts showing the beginning of fungoid infection. The part played by the other pigments is uncertain: e. g. leaves of *Laccinum Myrtillus* parasitised by *Gloeosporium* show equally excessive transpiration when they remain green as when they turn red.

Transpiration seems to depend yet more on the *condition of the transpiring surface*. Many parasites cause excessive evaporation of water in the organs of which they break the cuticle or cork layer. Mechanical lesions do not, however, explain excessive transpiration sufficiently and this must be partly attributed to modifications of the membranes. The intense transpiration and great water requirement of heterotrophic phanerogams and saprophytic fungi are also found in parasitic fungi. Parasites deriving carbonaceous food directly from the substratum must have a great absorption force. Intense transpiration, increasing the rate of absorption, is, therefore, characteristic of parasites.

Parasites are agents of a physical phenomenon — osmotic pressure — much more than of physiological or chemical phenomena (BEAUVENUE). They unbalance normal metabolism by modifying this pressure, causing hypertrophy of the infected organs by inducing a flow of crude sap; when their host dies its death is due chiefly to the excessive loss of water caused by their active transpiration.

- 300 - **Is Symbiosis Possible Between Legume Bacteria and Non legume Plants?**

BURKIL, T. J. and HAYES, R., in the *University of Illinois, Agricultural Experiment Station, Bulletin No. 20*, pp. 115-181 + 12 Plates + Bibliography of 169 Publications. Urbana, Illinois, July, 1917.

The authors have studied the bacteria of Leguminosae and have attempted to develop between the nodule bacteria of Leguminosae and the roots of non-leguminous plants a symbiosis similar to that between *Pseudomonas radicola* and Leguminosae. They did not deny that such experiments might give negative results, but there were also possibilities of success.

The preliminary studies, aiming at producing bacteria capable of living in symbiosis with non-leguminous plants, showed that nodule bacteria of Leguminosae may be divided into eleven groups, according to the plant host to which they are specifically adapted. By means of cultures the authors

(1) See *R.* Aug., 1918, No. 852. (Ed.)

succeeded in isolating *P. radicola* from all the sub-families of the Leguminosae. In inoculation and cultures the various nodule bacteria show permanent differences. They have, however, other such similar characters that it seems better to consider the forms adapted to the various hosts as varieties of one species. The nodules of the species *Ceanothus*, *Cycas*, *Alnus* and *Myrica* are not caused by *P. radicola*; those of the first species differ morphologically from those found on Leguminosae. According to the authors, it has not been definitely proved that the nodules of *Elaeagnus* and *Podocarpus* are formed by Leguminous bacteria or that any of these non-leguminous plants fix atmospheric nitrogen. The authors made numerous attempts to inoculate non-leguminous plants with the nodule bacteria of Leguminosae, but always with negative results. They are convinced that it is as yet impossible to draw any conclusion as to the possibility or probability of developing or finding nodule bacteria capable of growing on non-leguminous plants.

**PLANT
BREEDING**

301 - Activity of the Polish Society for the Selection of Cereals and Potatoes. —
Z. dtsch. f. Pflanzenzüchtung, Vol. VI, Pt. 2, pp. 116-117 Berlin, June, 1918

This Society, founded in 1915, has a selection Station at Oltarzew (Warsaw) and several nurseries. It selects wheat, rye, barley, potatoes and sugar beet.

WHEAT. -- Attempts are being made to obtain productive varieties with straw of average length, resistant to cold and lodging. The native varieties Wysokolitwka and Pulawka and the Squarehead variety are used for selection and hybridisation.

RYE. -- The aim is to obtain productive, green grained varieties with strong, supple, straw of average length, and resistant to the severe winters. The Loelch's Original Petkus's Variety is being studied.

BARLEY. -- The object is to obtain productive malt barleys with thin glumes. The variety studied is Brunner Hannagerte.

OATS. -- A productive yellow oat of average earliness and with thin glumes is sought. Variety studied: Loelch's Original Gelbhafer.

SUGAR BEET. -- A productive type, rich in sugar and sufficient early to do well under weather conditions giving 500 mm. of rain is aimed at. Variety studied: -- Kleinwanzlebener.

POTATO. -- Selection and hybridisation experiments are being made with the following varieties: -- Early Rose, Magnola, Blaue Riesen, and Wohltmann 39.

LABORATORIES. -- 1). Fully equipped laboratory for sugar beet selection, including a SCHMIDT and HENTSCH saccharimeter with magnifying scale, a WOLSKY press, and a PELLET polarimeter.

2) Laboratory for cereal selection, fitted with a precision balance, an automatic balance for weighing whole plants, a drum micrometer, etc.

METHODS. -- Individual selection and analysis of the progeny; separation of the best strains to isolate and fix the best homozygous plants. When necessary hybridisation tests will be made with the best strains, followed by individual selection.

302 - **The Definition of Species in System and Genetics.** - RAUNKJAER, C. in *Zeitschrift für induktive Abstammungs- und Variationslehre*, Vol. XIX, Pt. 4, pp. 225-240 + 2 Figs. Leipzig, August, 1918.

The definition of species and variety given by LINNAEUS largely no longer meets the needs of modern genetics or of the new facts discovered by it. The incompatibility between the new and old definitions which have become more and more emphasised as experiments on character inheritance have progressed, make it now very difficult for whoever wishes to reconcile the old school with the new. The author reviews the definitions of the species which have been given since LINNAEUS. There is a manifest tendency in them to save as much as possible of the Linnean species so as not to overthrow the vast systematic whole of the flora.

LINNAEUS' definition (given in his *Classificatio plantarum*, 5) may be rendered as follows: --- "Species are the different forms originally created by the Infinite Being which, in accordance with the laws of generation, have multiplied in forms always similar to each other; the various forms or structures existing today must, therefore, be considered species". This definition of species is completed by that of variety (*Philosophia botanica*, 1751, p. 100): --- "Variety is the plant modified by an accidental cause — climate, soil, heat, winds, etc. — which returns to its original state when the modifying action ceases".

According to the author this definition of variety is still accepted, except that non-inherited variations, caused by the momentary effect of external agents, cannot form systematic varieties, but only passing modifications or fluctuations. The species defined by LINNAEUS corresponds to the "self-fertilised homozygous unit" or "geno-species". It excludes all hybrids, the genetic importance of which has continually increased with the new Mendelian theories (behaviour of hybrids) and the recent investigations of JOHANNES (behaviour of pure strains).

It is not worth while to attempt to adapt the Linnean definition of species to the demands of genetics by twisting it round more or less. The Linnean species can at the most be retained in systematic biology by means of suitable modifications, but for genetics another definition is essential. Genetics and systematic biology differ too greatly in their methods and aims for the units of one to coincide with those of the other. Genetics study the individual by analysing its ascendants and descendants, whereas, systematic biology judges it in itself, by what it is at the present time. If, for example, a morphologist wishes to determine the systematic position of a white-flowered plant *A*, by means of genetic control, he must first make a series of long and difficult investigations, viz: —

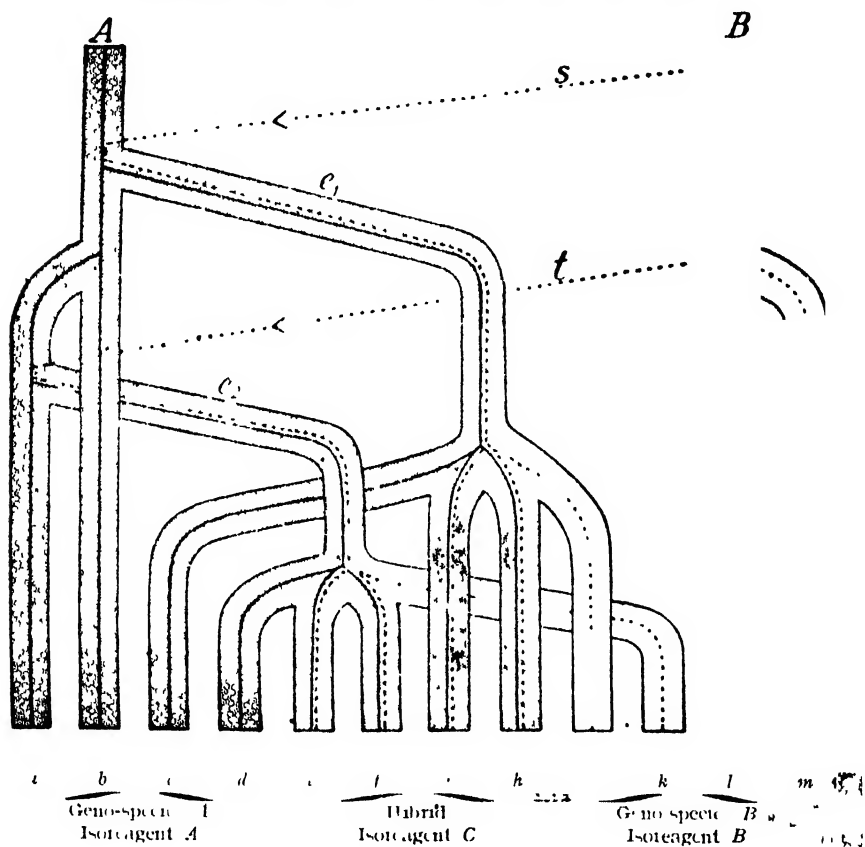
1) await the maturity of the seed produced by self-fertilisation; this necessitates controlling pollinisation;

2) sow these seeds and wait for the plants derived from them to flower. Two cases may then appear: - a) all the plants may have white flowers, from which it may be concluded that the individual *A* belongs to a white flowered "geno-species" or "homozygous biotype"; b) some of

the plants may have white flowers and some red ones thus showing *A* to be a "heterozygous biotype".

If forest trees were being studied the problem could only be solved after many years and the procedure adopted for one plant would have to be adopted for all the others in the forest. Such a method is not only impracticable, but even false from a systematic point of view, because two plants

Relations between systematic unity and genetic unity.



with the same characters are equal from a morphological standpoint whatever their ancestors were or their progeny may be. What matters in systematic biology is the principle of equality and the objective appreciation of differences and analogies. In nature and systematic biology the unit is the total of the individuals which, at the same moment of their development and under equal environmental conditions, react in the same way, producing forms indistinguishable from each other (in other words, "equal"). This unity is the "isoreagent" or "elementary species".

In genetics the "geno-species" or the total of the "homozygous

isogenic" individuals, which by reason of their homozygosis retain their constant character even through successive generations unless some mutation phenomena intervene, corresponds to the "isoreagent" of systematic biology. On the other hand, the total of the "heterozygous isogenic" individuals (of a hybrid character) cannot be included in one "geno-species", but form, together with the "geno-species", a higher group which cannot be compared with the "elementary species" or "isoreagent", viz the "biotype". This word defines the total of the "isogenic" individuals (i. e. those genotypically equal) both homozygous and heterozygous.

The appended figure helps to make clear the relations between the systematic unit ("isoreagent") and the genetic unit ("geno-species"). If A and B be two "geno-species" differing by one sole character and having no phenomena of dominance, fertilising A with the pollen of B (shown by the dotted lines s and t) will give a hybrid c_1 and a hybrid c_2 differing from both A and B . If these hybrids be self-fertilised they will give an F_2 with various types of descendants: — c_1 , will give c ($= A$), i ($= B$), g and h ($= c_1$); c_2 will give d ($= A$), k ($= B$), e and f ($= c_2$).

In this case genetics, basing itself on an analysis of the descendants, distinguishes two "geno-species" (A and B) and one hybrid. Systematic biology based on the principle of the "isoreaction" of the individual considered by itself, distinguishes three "isoreagents" of equal value (A , B , C). As genetics does not hesitate to bring i to the same unit as B , although it is derived from a very different parent, c_1 , so systematic biology does not scruple to unite c , f , g , and h in one sole unit the "isoreagent" C , considered as being equal in value to A and B .

CONCLUSIONS. — 1) Genetics determines the value of an individual by its ancestors.

2) Systematic biology determines the value of an individual by what it is itself.

3) Genetics is based on the principle of "isogeny".

4) Systematic biology is based on the principle of "isoreaction".

5) In genetics the unit is the "geno-species" or total of all the "homozygous-isogenic" or "homozygous biotypical" individuals.

6) In systematic biology the unit is the "elementary species" or total of individuals reacting in the same way or "isoreagents".

303 - Experiments in the Transformation of Winter Cereals into Spring Cereals, in Austria. PRÜWIRTH, C., in the *Zeitschrift für Pflanzzüchtung*, Vol. VI, Pt. 1, pp. 1-46, Berlin, March, 1918.

There are three different forms of cereals: -

1) "Winter" forms, distinguished not only by specific resistance to cold, but also by the capacity to delay considerably the vital functions during winter (anabiosis [I]), thus making them less sensitive to the action of low temperatures.

2) "Spring" forms, slightly resistant to cold and little or not at all subject to "anabiosis", distinguished by rapid growth and earing which enable them to ripen in spite of late sowing.

(1) See R., March 1917, No. 228. (Ed.)

3) "Winter-spring" forms, capable of developing completely whether sown in spring or winter and uniting marked rapidity of growth with resistance to cold.

The author gives the results of experiments on the transformation of "winter" cereals into "spring" cereals, made at Waldhoff, near Ainstetten, Austria, in heavy clay soil, at an altitude of 950 ft. The experiments were divided into three groups :-

1) SOWING. Winter forms sown in early spring tiller abundantly and form numerous shoots or lateral ramifications which are nearly always sterile. This vegetative growth is made at the expense of reproductive growth and is more marked the later the seed is sown. Most varieties sown in February ear normally, whereas of those sown in March only a few plants, or a few stalks per plant, have fully ripened grain.

2) EFFECTS OF FROST. - Frosts occurring while the plants are coming up or after they have done so, do not stimulate earing so as to compensate for the delay suffered by winter forms sown in spring. For these forms to develop reproductively under such conditions the seedlings must, during the first period of growth, be exposed for a sufficient length of time to temperatures below those to which the older plants will be subjected. In southern countries where the winters are mild, wheat sown in autumn ears and ripens normally without frosts, as to do this they only require a relatively low and fairly constant temperature during winter with a gradual rise in spring. Grain sown very early in autumn does not, however, ear before or during the winter because, at that season, the temperature gradually decreases.

3) CHARACTER INHERITANCE. - The author attempted to transform winter cereals into spring ones by repeated spring sowings. Winter forms were sown in February or March and, for the second sowing in the following spring only fully ripened seed was used. This procedure was continued for several consecutive years, so as to obtain winter forms capable of being sown in spring. The results obtained varied with the cereal used — wheat, rye, and oats.

a) *Wheat*. - Pure strains of "Böhmischer Wechselweizen" and "Sperrlings braunkörniger Buhendorfer Weizen" gave absolutely negative results, seed from spring sowing acting like that from winter sowing. The case of the spring wheat "Roter Schlanstedter", derived from the winter wheat "Bordeaux rouge inversable", cannot be accepted as conclusive because the latter is really a winter-spring form. During the comparative tests of the two wheats "Bordeaux" and "Schlanstedter" in 1915, in which each was sown successively on February 11 and March 17, both eared almost at the same time.

b) *Rye*. - Gave both negative and doubtful results. The winter rye "von Lochow's Petkuser" was interesting. From 1914 to 1916 there were two sowings each year, one in February and one in March. The plants sown in March did not ear the first two years and, in 1916, produced only a few ears with seed incapable of germinating. The plants sown in February always developed normally. In 1917 some of the seed produced by these

plants the previous year were sown in March instead of February, and, in spite of the lateness, produced rye which eared and ripened at the same time as that sown in February, thus giving a positive result.

c) *Barley*. — All the so-called winter forms of barley sown in spring gave plants which developed normally, showing them to be really "winter-spring" forms. Several varieties of cereals said to be "winter" or "spring" forms and grown as such are probably really mixed forms capable of immediate transformation without special preparation or treatment.

SELECTION. — GRABNER's experiments have shown that in many cases, especially those of wheat, the varieties are really "populations", even in their "winter" or "spring" characters. Next to bearded or unbearded forms, those with smooth or hairy glumes, or those ripening early or late, are "winter" or "spring" forms mixed with "winter-spring" forms. Hybridising experiments made by TSCHERMAK show that the "winter" or "spring" character of a form is Mendelian.

In wheat the "winter" character is dominant to the "spring" character, so that when winter and spring wheat are crossed the F_1 is composed entirely of winter forms, whereas the F_2 contains 3 winter forms to 1 spring one. In rye and barley, however, the "spring" character is dominant, and the F_2 contains 3 spring forms to 1 winter one. This character probably depends on several determinants. Consequently crossing, normal in rye, rare in barley, and yet rarer in wheat, gives rise to different combinations which complicate selection. In selection, therefore, the method adopted to transform winter varieties into spring ones will vary according to whether the forms used are self-fertilising (wheat and barley) or cross-fertilising (rye).

a) *Wheat*. — The seed of a certain number of plants is sown in spring. Three cases may arise :—

1) All the plants ear and ripen regularly. In this case the form is mixed and may be grown without special preparation as a spring wheat.

2) Some of the descendants ear regularly and some do not. This is a case of mixed "population" including both "winter" and "winter-spring" forms. The normal descendants (those earing regularly) may be cultivated as spring forms without special preparation.

3) In all the descendants earing is late and irregular and many secondary, sterile stems are formed. This is a case of a pure strain having all the "winter characters". Positive results may be obtained by selection.

b) *Rye*. — The method to be adopted is longer and more complicated. Crossing gives rise to many gametic combinations including all the transition forms. It is necessary to isolate plants which are homozygous with respect to speed of earing. The best method may be to sow in spring during several consecutive years and eliminate the plants showing "winter" characters.

304 - Contribution to the Technique of the Artificial Fertilisation of Wheat. — JELINEK, J., in the *Zeitschrift für Pflanzenzüchtung*, Vol. VI, Pt. 1, pp 55-57 Berlin, March, 1918

Wheat may be artificially fertilised by two methods : — 1) by placing

in contact with the female part of each flower deprived of its male organ (male castration) the ripe anthers removed from the ear to be used in the cross; 2) by the same method but, instead of the anthers, using the pollen itself, collected in the laboratory with all the necessary care. In experiments made at Prague the author obtained bad results by both these methods, the percentage of setting being always very low. He describes a somewhat different method which, in spite of its great simplicity, has always given very satisfactory results.

The plants to be crossed are sown side by side. If an early and a late variety are used the first is transplanted next to the second; flowering being thus delayed the two plants will flower at the same time. One ear is then chosen from each plant and both (the castrated ear and the whole ear) tied together and wrapped in a parchment bag. By these means percentages of setting have been obtained much higher than those given by the ordinary methods. In 1916 the average number of seed per ear was 4.6 with the author's new method, and 2.1 with the usual method.

305 - Correlation between Resistance to Cold and Colour of the Glumes and Grain in Winter Wheat. See No. 304 of this Review.

306 - Bud Variation Observed in Early Rose Potatoes in Poland. REX, V. G., in the *Deutsch-Landwirtschaftl. J. Preuss. Ostpreuss.*, Berlin, 1918.

In 1914 and 1915, at the Selection Station of Oltarzew (1), near Warsaw, in fields of Early Rose potatoes, certain plants attracted attention by their great resistance to mildew (*Phytophthora infestans*). In 1916 and 1917 some of these plants were propagated and carefully examined morphologically and physiologically.

In addition to its resistance to mildew the new form is also distinguished by the appearance of its terminal folioles, which are slightly shortened and rounded at the end. The author believes this to be a case of mutation, or more correctly, bud variation.

307 - Investigations into the Dominance of Paternal and Maternal Characters in Reciprocal Crosses Between the Yellow Cherry and Dandy Dwarf Varieties of Tomato, in the United States. - HAYSTAD, B. D., in *The Journal of Heredity*, Vol. IX, No. 1, pp. 169-173, Washington, April, 1918.

In his experiments the author used two varieties of tomatoes with characters as widely opposed as possible. The table on p. 279 shows these characters together with those observed in the reciprocal F_1 hybrids.

RECIPROCAL F_1 HYBRIDS. - The table shows the dominance of the Yellow Cherry characters in both the reciprocal hybrids with respect to height (normal), the colour of the leaves (green), and their thickness (slight). There is, however, dominance of the Dandy Dwarf "red fruit" character. On the other hand, the first hybrid (with Yellow Cherry as female parent) has slightly lighter and smaller fruit than the second hybrid (with Dandy Dwarf as female parent). This shows that in both, the weight and size of the fruit tend to the maternal type.

(1) See No. 304 of this Review (Ed.)

	Height of plant	Leaves		Colour	Fruit		
		Colour	Thickness		Colour	Average weight in grammes	Average length in mm
<i>Parents:</i>							
Yellow Cherry	normal	green	slight	yellow	5.40	16.70	19.40
Dandy Dwarf,	dwarf	yellow	great ('1 potato leaves)	red	23.80	27.70	37.40
<i>Hybrids F₁:</i>							
Yellow Cherry ♀ × Dandy Dwarf ♂.	normal	green	red	red	16.29	25.99	32.80
Dandy Dwarf ♀ × Yellow Cherry ♂.	normal	yellow	red	red	16.47	28.42	34.02

RECIPROCAL, F_2 HYBRIDS. -- As in F_1 , the characters, height of plant, colour and thickness of leaves, and colour of fruit, fall into one group, and weight and size of fruit in another, but, in the second generation these groups do not behave as in the first.

Dominance of maternal characters. In each of the two crosses 120 plants of the F_2 were examined. The theoretic Mendelian ratio between the dominant and recessive types is 94.5 : 31.5 (or 3 : 1), but, in reality, as the following table shows, the number of plants with dominant characters found exceeded the theoretical number (106 normal plants and 20 dwarf plants, or about the ratio 5 : 1)

Reciprocal crosses	Height	Number of plants	Percentage of green-leaved plants	Percentage of yellow-leaved plants
Yellow Cherry ♀ Dandy Dwarf ♂	normal	106	74.5	25.5
	dwarf	20	85.0	15
Dandy Dwarf ♀ Yellow Cherry ♂	normal	106	81.1	18.9
	dwarf	20	65.0	35.0
Total of the two crosses	normal	212	77.8	22.2
	dwarf	40	75.0	25.0

On the other hand there is an excess in the inverse sense in the number of plants with the recessive character "thick leaves", these numbered 41 instead of the theoretical 31.5, so that the ratio between the dominant type with thin leaves and the recessive type with thick leaves was only about 2 : 1 (85 : 41) and not the theoretical ratio of 3 : 1 (94.5 : 31.5).

The preceding table shows that yellow and green leaves are found both in normal and dwarf plants (1). The ratio between the percentage

(1) This shows that the determinant of the habit of growth and that of leaf colour should occur in two different chromosome. *Ed.*

of green plants (dominant) and that of yellow plants (recessive) agrees with the theoretical ratio 3 : 1 in dwarf plants (75 : 25) and is close to it in normal plants (77.8 : 22.2) if the two crosses be considered together. This ratio, however, varies greatly in different crosses. In the first (with green-leaved Yellow Cherry as female parent) 85 % of the dwarf plants had green leaves and 15 % yellow leaves. In the second cross (with yellow-leaved Dandy Dwarf as female parent) only 65 % of the dwarf plants had green leaves whereas 35 % had yellow ones. These figures clearly show the dominance of the maternal character in the colour of the leaves.

The average percentages of the thickness of the leaves and colour of the fruit are given in the following table which also shows the dominance of the maternal characters : —

Reciprocal cross		normal	Height		Leaves		Fruit		
			dwarf	green	yellow	thin	thick	red	yellow
Dandy Dwarf ♂	× Yellow Cherry ♀	84.1	15.9	79.8	20.2	77.4	22.2	75.7	21.3
Yellow Cherry ♂	× Dandy Dwarf ♀	84.1	15.9	73.1	26.9	69.5	30.5	82.3	17.7

Dominance of paternal characters. — In the case of weight and size of fruit the observations are the opposite of those noted for the preceding characters, i. e. the male parent is dominant. This is shown by the following results : —

Reciprocal cross		Fruit		
		Average weight in grammes	Average length in mm	Average width in mm
Yellow Cherry ♀	× Dandy Dwarf ♂	12.19	2.13	20.19
Dandy Dwarf ♀	× Yellow Cherry ♂	12.54	2.30	25.12

CONCLUSIONS. A study of the F_2 of reciprocal crosses between two widely differing varieties of tomato shows that, in the two crosses, the Mendelian characters of the female parent are dominant in the height of the plant, colour and thickness of the leaves, and colour of the fruit, but in the weight and size of the fruit the characters of the male parent are dominant.

There is a positive correlation between the weight and size of the fruit and : — 1) dwarf growth (Dandy Dwarf) ; 2) green leaves (Yellow Cherry) ; 3) thickness of leaves (Dandy Dwarf) ; 4) red fruit (Dandy Dwarf).

Green leaves, containing more chlorophyll than yellow ones, probably also have a greater photosynthetic activity ; this would explain the posi-

tive correlation between the size of the fruit and the characteristic green leaves of Yellow Cherry. This is, however, the only correlation in this variety; the other three concern the Mendelian characters of the Dandy Dwarf tomato. ¶

308 - Type of Dry Blood Orange Springing from a Bud Variation, in California.

— SHAMFL, A. D. in *The Journal of Heredity*, Vol. 1X, No. 1, pp. 174-177 + 2 Fig. Washington, April, 1918

In 1916, in a citrus plantation near Corona, California, the author observed on a Ruby blood orange plant (*Citrus sinensis* Osbeck), a branch differing distinctly from all the others by its narrow, long, lance-shaped leaves, and still more by its thick rinded fruit (almost double the normal rind) and pulp which was not red and juicy, but straw coloured and quite dry. All the 76 fruits borne by this branch had the same characters. It was obviously a case of bud variation (bud mutation).

Closer examination immediately showed the existence of not only over one hundred of these mutation branches, but even of whole trees belonging to the dry type. On both the mutation branches and trees there were always found, together with a small number of contingently normal fruits of a mixed type, a large number of dry fruits which, at first sight, could not be distinguished from the others, so that they might be sent to market and cause the producer unjustly to be blamed.

It is, therefore, necessary to choose grafting material with greater care and to take it only from plants which have been carefully observed each year (1). The haphazard taking of grafting material has done much to propagate these bud variations as well as other commercially useless ones.

309 - Experiments in Crossing *Quercus virginiana* and *Q. lyrata*, in the United States.

— NEES, H., in *The Journal of Heredity*, Vol. 1X, No. 6, pp. 267-269 + 3 Figs., Washington, October 1, 1918.

The overcup oak (*Quercus lyrata*) and live oak (*Q. virginiana*) although belonging both to the sub-division *Lepidobalanus* of the genus *Quercus*, differ so greatly that they form the two extremes of this group of species.

The characters of *Q. virginiana* are:— 1) short trunk, wide crown, with twisted branches; 2) rough bark with deep crevices; 3) oblong to elliptical, tough leaves, with unbroken edge, remaining on the tree till spring; 4) long, oval acorn, ²/₃ longer than the cup; cup with thin scales coming to a point and membranous edges.

The characters of *Q. lyrata* are:— 1) long trunk; pyramid-shaped crown, with straight branches; 2) stratified flakey bark; 3) leaves much larger than those of *Q. virginiana*, of papery consistency, and deeply dented edges, falling early, in autumn; 4) short, globular acorn almost completely covered by the cup; cup with very thick scales.

The results are given of a series of crosses between *Q. virginiana* and *Q. lyrata*. Artificial fertilisation was carried out twice— in April, 1909 and

(1) Remark made also with reference to the Valencia orange and grape fruit in California— see *R. Doc.*, 1918, No. 1337 and *R. Jan.*, 1919, No. 37 respectively (*Ed.*)

in April, 1910. Seven hybrids sufficiently developed to make it possible to judge their specific characters were obtained.

1) In manner of growth the trees of the second lot (1910 cross) resembled *Q. lyrata* and had pyramid-shaped crowns and very straight branches. The plants of the first lot (1909 cross), however, were more like *G. virginiana* — short trunk, wide crown, slightly twisted branches, short internodes.

2) The bark, already differentiated at the base of the most developed trees, resembled that of *Q. lyrata*.

3) The leaves begin to fall in winter but a few remain green till spring (character intermediate to that of the parent). Shape and size — very uniform intermediate to those of the parents — shape oblong to lance-shaped and dented edges, texture tough (as in *Q. virginiana*); upper surface a fine green, brighter than that of *G. lyrata*.

4) Fruit of intermediate size, resembling that of *Q. virginiana* in shape but much shorter.

As ornamental plants, these hybrids are much superior to the female parent (*Q. virginiana*) in shape and to the male parent (*G. lyrata*) in the density of their foliage and the colour of their blades.

**CEREAL
AND PULSE
CROPS**

310 **Yields of Winter Grains in Illinois, U. S. A.** — BURLISON, W. L. and ALLEN, O. M., in the *University of Illinois, Agricultural Experiment Station, Bulletin No. 201*, pp. 97-110. Urbana, Illinois, June, 1917.

This bulletin gives a report and short discussion of field experiments made with different varieties of wheat, rye and winter barley at De Kalb, De Kalb County, Urbana, Champaign County, and Fairfield, Wayne County. A summary is also given of the results of wheat tests previously made at Cutler, Perry County, as well as of those of experiments made in 1915-1916 with rye, barley, emmer, and oats. The results are given in tables.

At De Kalb experiments with winter wheat varieties were begun in 1907, using the Dawson Golden Chaff variety for purposes of comparison. The most productive variety for northern Illinois seems to be Turkey Red. Other productive varieties grown over at least 3 years — Turkey 9-233, Malakoff 5-458, Minnesota Reliable, Wheedling 5-464, Kharkof, and Malakoff gave average grain yields of 37.2, 37.6, 36.1, 35.2, 32.6, 31.4 bushels per acre respectively. The Turkey Red variety yielded 35.4 bushels of grain per acre as a 7-year average.

All the winter barleys were destroyed by frost. Four tests with Petkuski winter rye and Wisconsin pedigree rye gave an average of 55.5 and 47.0 bushels per acre respectively.

The winter wheat tests at Urbana were begun in 1904, using the Turkey Red variety for comparative purposes. The average yields (in bushels of grain per acre) of the principal varieties tested for 5 years or more were:

Turkey Red 42.4 (12 years), Malakoff 42.0, Fultz 42.1, Hungarian 39.7, Pesterboden 41.8, Beloglina 40.4, Kharkof 42.0, Dawson Golden Chaff 49.5. Other promising varieties for central Illinois are Turkey Hybrid 509 and Dawson Golden Chaff 9-225.

The winter wheat experiments at Fairfield were begun in 1906, using the Fulcaster variety for comparison. The following varieties gave the highest average yields (in bushels per acre) during at least 3 years: -- Fulcaster 15.9, Economy 16.9, Missouri Pride 15.8, Indiana Swamp 14.0, Wheedling 14.5, Harvest King 14.3, Rudy 12.3, Poole 12.0. In some years the Fulcaster variety was surpassed by the Economy, Wheedling, Missouri Pride and Harvest King varieties. Hard wheats, such as Turkey Red and Kharkof did not prove suitable to the conditions of southern Illinois.

The tests made with winter cereals at Cutler in 1916 gave the following results (in bushels per acre): -- Wisconsin Pedigree rye 43.4, Wing Black rye 46.8, Salzer's winter barley 22.7, Michigan winter barley 17.5, winter emmer 52.0. The winter oats did not resist the frosts.

A table gives the characteristics of the winter wheats tested at De Kalb, Urbana and Fairfield.

311 - Results of the Cultivation of Manitoba Wheat in the Vaucluse Department, France, in 1918. — ZACHARLWICZ, E. in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 3, pp. 115-116. Paris, January 27, 1919.

In continuation of his previous paper on the results obtained in growing Kurrachee, Aurore, Marquis and Manitoba spring wheat in Vaucluse (1), the author reports those obtained with Manitoba wheat in collaboration with M. RICARD on his estate near Mornas (Vaucluse).

The area sown was 2.2 acres. The soil, part of the recent alluvion of the Rhone, is sandy clay and had just been planted to carrots in rows. The seed was sown after ploughing, without any fertiliser, on March 25, 1918, at the rate of 396 lb. (or 180 lb. per acre). Vegetation lasted 115 days, and was normal. On July 20, when the grain was cut, the stems were 35.27 inches high. The yield was 4 580 lb. (or 2 082 lb. per acre).

The author's tests show Manitoba and the other above mentioned wheats to be excellent for the south of France, where only winter sowing has hitherto been adopted, thus hardly allowing for the cleaning of land invaded by weeds. These varieties could be sown during March, and, in land not exposed to drought, during the first days of April, thus leaving plenty of time for preparing the land well. Moreover, as they grow rapidly they outstrip the weeds, especially wild oats and stop their growth.

312 - Cultural Tests of Various Wheats at Nages (Tarn), France. See No. 278 of this Review.

313 - Rice Growing in Ceylon: Green Manures. See No. 288 of this Review.

314 - On Sorghum. DYBOWSKI J. (notes by GOUIN, A., ANDOUARD P. and PHÉLIPPE, A.) and DECHAMBRE, in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 2, pp. 62-65, 73-76, and 76-78. Paris, January 15, 1919.

M. DYBOWSKI draws attention to the value of sorghum from the French Colonies, especially French West Africa, to breeders in France, and presents to the Academy a note by MM. A. GOUIN and P. ANDOUARD on this subject.

(1) See *R. Dec.* 1918, No. 1319. (Ed.)

This note shows all the advantages to be gained from the use of sorghum in pig breeding by adding to this grain a certain quantity of nitrogen and lime.

The authors show that a young hog of from 55 to 66 lb. fed solely on sorghum would not eat more than 1000 gm. of it daily. These 1000 gm. would only supply 50 gm. of utilisable nitrogenous matter, and a daily gain of 700 gm., normal in intensive breeding, requires at least double that quantity. Moreover, body maintenance appears to require 15-20 gm. Growth would be compromised were nitrogen lacking. No less serious is the fact that sorghum, like nearly all grain used in feeding, is almost entirely deficient in lime, which is necessary to the development of the frame.

Sorghum could easily be made thoroughly suitable to intensive pig breeding by adding to it 200 gm. daily of a food containing much nitrogen, such as groundnut cake and a good handful of bone meal. In less than 4 months a hog weighing at the beginning 55 lb. should yield 165 lb. of meat by the consumption of 55 lb. of groundnut cake, 22 lb. of bone meal, and little more than 440 lb. of sorghum.

M. DYNOWSKI also presents a note by M. A. PIEDALLU, who lay stress on the variations in the characters of sweet sorghum and shows how they should be fixed, first by careful selection, then by artificial propagation, such as cuttings. Sorghum stems take root very easily and the author was able to propagate specially productive plants by cuttings of the stems. These cuttings fructified easily and the seed thus obtained made it possible to propagate high yielding varieties rapidly.

In his experiments with cuttings the author first planted bits of stem obliquely in the soil. In spite of drought with watering about half of the cuttings grew. He found the failure of the other half to be due to the fact that the leaf sheath hindered the growth of the roots at the nodes. He therefore cut out the leaf sheath by a circular incision at the base. About 3 to 4 cm. of the stem cut on a slant was left on each side of the node and the cuttings planted in pots. The soil in the pots was covered with moss and the pots put under bell jars. They were well watered and exposed to the sun. In 8 days the roots had grown and all the young shoots had appeared. All the cuttings were successful.

M. DECHAMBRE shows that in feeding horses 900 gm. of sorghum may be substituted for 1000 gm. of oats. Horses can eat several pounds of sorghum daily (4 to 7 generally), together with oats and other concentrated foods. In West Africa (Senegal, Sudan) sorghum forms the only food of horses and mules. M. TRICARD, Army Veterinary Surgeon, says that sorghum is fed in French West Africa without the addition of other nitrogenous foods, and that horses and mules from France, as well as the native ones, keep in excellent condition on this ration.

315 - Grain Sorghums, in California. — MADISON, B. A. in the *University of California Publications, College of Agriculture, Agricultural Experiment Station, Berkeley, California Bulletin* No 278, pp 227-250 Berkeley, April 1917

This bulletin gives a detailed discussion of the adaptability, yield and value of the different varieties of grain sorghum grown in California. At Davis, from 1913 to 1916, comparative tests were made of the grain yield

of 6 varieties of durra, 6 of kafir corn, 4 of kaoliang and 1 of shallu. The maximum average yield (3 575 lb. per acre) was given by Dwarf Milo. Dwarf Black-Hull, with a yield of 1962 lb. per acre was the first of the kafir varieties. The first place among the kaoliang sorghums was held by the Brown variety which yielded 2 902 lb. per acre. On an average the Shallu sorghum yielded 3 542 lb. per acre. Of the seven varieties (Dwarf Milo, Standard Milo, White Milo, Feterita, Dwarf Black-Hull kafir, Early Black-Hull kafir, and Black-Hull White kafir) best suited to cultivation as fodder plants, the highest average yield in straw and grain for 1914 and 1915 was given by Black-Hull White kafir, with 16 06 tons per acre, and the lowest by Feterita with 7.01 tons per acre. The best results were obtained by sowing between April 10 and 20 with a weight of seedling varying from 2 lb. to 6 lb. per acre, according to the environmental conditions.

A table shows the percentage composition of the grain of 5 varieties of durra, 3 varieties of kafir, 1 of kaoliang, and 1 of shallu, cultivated in 1914; they are compared with maize and barley. The respective averages for each of these groups and all the sorghums analysed were. Water 11.09, 12.44, 10.78, 12.85, 11.44; Protein 9.62, 9.49, 10.23, 9.28, 9.76; Fat 3.02, 3.43, 3.54, 3.93, 3.34, Fibre 1.58, 2.06, 1.98, 1.63, 1.76, Carbohydrates 72.99, 70.79, 71.42, 70.74, 71.82; Ash 1.69, 1.65, 2.04, 1.57, 1.78. From these results the author concludes that the food value of sorghum, either as grain or silage, is a little below that of maize. Sorghum, grown as a second crop, is imperfectly developed and sometimes has toxic properties resulting from the prussic acid contained in its leaves. This never or hardly ever, occurs in the first crop, which is perfectly free from all injurious substances.

Sorghum is relatively free from disease. Its principal enemies are blackbirds, which eat the seed.

310 - **Soybeans; Their Culture and Use, in Ohio, U. S. A.** WILLIAMS, C. G. and PARK, J. B. in the *Ohio Agricultural Experiment Station, Bulletin* 312, pp. 581-600, Wooster, Ohio, March, 1917

CULTIVATION - The cultivation of the soybean in Ohio, where it was grown over 4 921 acres in 1917, is discussed in detail. In experiments made to determine the most favourable rate of sowing the seed 3 pecks per acre of the Medium Green variety seeds sown in lines 28 inches apart gave the best results for seed production. Sowing in lines at the rate of 8 pecks per acre gave less seed, but a larger total quantity of fodder.

The 5 best varieties, in decreasing order, were: Ohio 9 016, Ohio 7 496, Elton (Chestnut), Ito San 17 268, Shingto. The 5 least productive varieties were: - Sable, Cloud, Yoshio, Mikado, and Taha. As an average for the 5-year period 1911-1916, the grain yield per acre varied from 14.01 bushels for the Sable variety to 29.22 for Ohio 9 016. In the high-yielding varieties the ratio between straw and grain was low: 72 lb. to 97 lb. of straw (on an average 81 lb.) per bushel of grain. In the low-yielding varieties this ratio was 106 lb. to 164 lb. of straw (on an average 133 lb. per bushel of grain. The difference in the average straw yield of both groups

was only 177 lb. per acre. The results are also given of tests made with certain varieties on experimental farms in the counties of Clermont, Hamilton, Washington, Paulding and Trumbull.

Tests with 10 soybean varieties as Leguminosae for hay were made at Wooster during 5 years. The Medium Green variety gave the highest average yield (5402 lb. per acre) and the Mammoth Yellow variety the lowest (3814 lb. per acre). The Medium Green variety is better suited for the production of hay than for that of seed, on account of its tendency to let the ripe seed fall.

Observations have been made on the influence of soybeans on the crops following in the rotation. Fifty such rotations are in progress. In 1916 were harvested 24 plots of wheat, of which 10 followed on maize, 6 on soybeans, 5 on potatoes, and 3 on oats. After soybeans the average wheat yield per acre exceeded that after maize by 10.3 bushels, that after oats by 1.27 bushels and that after potatoes by 0.34 bushels.

USIS. The uses of soybeans as a human foodstuff are described and diagrams given comparing the food value of the soybean to that of some of the common foods. Among the preparations common in the Far East which might be introduced in the kitchen of white people are: — 1) soybean sauce, or "shoyu", prepared with equal parts of wheat and soya by a process lasting one or two years, 2) soybean milk, prepared by grinding the seed finely, mixing them with about ten parts of water, boiling the mixture for 15 to 30 minutes, leaving it to stand, and decanting it; to the decanted liquid is added that obtained from the deposit by pressing in a cloth (1), the yellowish-white liquid thus obtained leaves no deposit so long as fermentation is prevented, it contains about 3.7 % of protein, 2 % of fat, 1.8 % of carbohydrates, and 0.5 % of salts. If a small quantity of acid or of a calcium or magnesium salt be added to the soybean milk, or if it be left to sour spontaneously, a curd forms which may be drained, pressed and eaten as a soft cheese. This is the "tofu", so largely consumed in the East, where it is prepared daily and eaten like bread is in Europe; salted and fried, or well seasoned as salad, it is very tasty. Soybean milk thus prepared is not relished by Western peoples, but has given good results when used in making bread, pastry, milk chocolate, sauce for seasoning vegetables, etc. It may also be used as a food for young animals — cattle, pigs, and poultry. The residue obtained in its preparation is also a good food, or may very well be used as a fertiliser.

Soybean meal may be prepared either by direct grinding of the seed or by grinding the cake obtained after the oil has been extracted; the second kind keeps better. To free the seed from its characteristic strong flavour it should be left to macerate for 12 hours in cold water, which should then be replaced by boiling water in which the seed is left for 2 hours. To keep it tender it should be boiled with a little soda. It is better still to take the pods when they have macerated for 9 hours, boil them whole, shell them, and prepare the seed thus obtained in the manner required. The

(1) A slightly different method was described in *R. Feb.*, 1919, No. 251. (*Ed.*)

advantage of the soybean as a food lies in the fact that it supplies a large quantity of nutritive matter at a low price.

317 - Cultivation of Different Varieties of the Castor-Oil Plant in the South of France.

— JUMELLE, H., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 1, p. 45-47 Paris, January 8, 1919

PLANTS
YIELDING
OILS, DYE-
TANNINS, E

The use of castor oil for lubricating motors has caused an increase in the cultivation of the plant producing it. Not only have the French colonies been encouraged to develop and improve the cultivation of the castor-oil plant (1), but the Ministry of Agriculture has recommended it, for the present at least, in the south of France.

Cultural tests have been made with different varieties at the Botanical Garden of the Faculty of Science of Marseilles, and the Botanical Garden of the town, of which the author is the director. The seed used was obtained from Morocco, French West Africa, Indo-China, Madagascar, the French Indies, Martinique, and Brazil.

Of the 23 varieties studied, twelve ripened specially well in the Mediterranean climate. They were: "Ricin sanguin de la Chaouïa", "Ricin sanguin du Sénégal", "Ricin sanguin du Soudan" (three similar, if not identical, varieties), "Ricin sanguin du Brésil" (also similar in some respects to the preceding ones), "Gros Ricin sanguin de Cayes", "Ricin Pale du Sénégal", "Ricin brun du Sénégal", "Ricin noir du Sénégal", "Petit Ricin gris d'Indochine", and the two "Petit Ricin gris-tougeâtre" of Bombay and of Pondichéy.

318 - "Cay-sen", a Sapotaceous Plant with Oil-Yielding Seed in Tonkin. — Lecomte, H., in the *Bulletin Économique de l'Indochine*, Year XXI, N. S., No. 132, pp. 735-741 + 2 Pigs., Hanoi-Haiphong, September-October, 1919.

The author mentions the work already published on the "cay-sen" in the *Bulletin économique de l'Indochine* (2). The tree is of slow growth and it flowers in about its 15th year. The flowers appears in May, and the fruit ripens in November and December. The fruit is edible and chiefly appreciated by monkeys and birds though the natives sometimes use it to quench thirst. The oil is extracted by grinding the seed in a mortar used for polishing rice, then slightly heating and pressing. The yield is fairly uniform, 100 litres of seed giving 10 litres of oil. After being purified by boiling and decanted the oil is yellowish and thick, with a slightly rancid smell. It is used as a food and for burning, and in 1911 was sold at \$0.20 a litre (\$ = 2 s. 1 1/2 d at par). M. Bussy's analyses show the fat content of the whole seed (kernel and skin) to be 25.85 %, i. e., about 26 %, and that of the kernel alone without the skin to be 30.12 %.

'Cay-sen, so valuable for its oil, was named *Illipe tonkinesis* Pierre by the botanist PIERRE who was unable to describe it because he did not

(1) See K May, 1918, No 526, Nov 1918, No 1188 and R., Jan 1919, No 53. (Ed.)

(2) *Bulletin économique de l'Indochine*; 1911, pp. 478-480, Note by M. GIBERT on the Cay-sen, etc.; 1912, No. 98, p. 753, Analyses of Cay-sen seed by M. RIGOTARD; 1914, No. 107, p. 208, Detailed Note by M. LEMARIÉ giving the characters of the plant under the name of *Illipe* sp.; this paper includes analyses of the seed by M. BUSSY. (Author)

know the flowers. DUBARD was only able to give an incomplete description of the plant because the one branch at his disposition had but very young flowers; he created the new genus, *Dasillipe* and called the plant *Dasillipe Pasquieri*. The author, having material in perfect flowering condition, places the plant in the genus *Bassia* under the name of *Bassia Pasquieri* (M. Dub.) H. Lec. He gives a description of it in Latin

319 *Orbignia speciosa*, a Palm with Oil-Yielding Nuts, in Ecuador. — *Oleonen Vellen*, Ycat, III, No. 23, p. 177. Amsterdam. December 1918.

In Ecuador, at the foot of the western Andes, is a district in which are grown all kinds of tropical plants, including the coffee and cacao trees. Part of this district is covered with a species of palm, *Orbignia speciosa*, the oil-yielding nuts of which ripen all the year round. The yield from one tree is estimated at 990 lb. of nuts, which, in drying, lose 50 % of their initial weight. Sixty per cent of the product extracted from the kernels is fat, of which the yield per tree annually is 99 lb.

RUBBER,
GUM AND RESIN
PLANTS

320 — Production of Guayule Rubber. — PARSON, H. C., in *Commerce Reports*, No. 149, pp. 1172-1184. Washington, D. C., 1915.

Even before the Spanish occupation northern Mexico was a rubber producing country, the source being a shrub or dwarf tree to-day known as guayule. The native obtained the gum using it to make toy balls. The plant was discovered by Dr. J. M. Bigelow in 1852, and was later described and named *Parthenium argentatum* by Prof. Asa Gray. In 1876 a guayule product, known as Iruango rubber, was exhibited at the Philadelphia Centennial Exposition.

It was not until 1888, however, that any attempt was made to extract the gum commercially: in that year were imported 100 000 pounds of the shrub, known as "hule", the bark when removed yielded about 18 % of rubber; because of the expense of transportation and treatment the experiment was not repeated.

In 1899 Guglielmo Prampolini, took out a patent for extracting guayule by solvents, which was followed by a large number of patents for extraction processes, some practical, some otherwise, and for several years afterwards applications for patents for this purpose were numerous. Beginning in 1902, an American capitalist financed a series of experiments that led to an invention by W. A. Lawrence, by which, in 1904, rubber was extracted by a mechanical process, and 50 pounds were shipped to the United States. This was the real beginning of the extraction of guayule on a commercial basis in Mexico, and in 1906 it began to be used in quantity. Factories established in the States of Durango, Coahuila, San Luis Potosi, and in Texas soon produced large quantities of rubber. Improvements in the processes of extraction tended to produce superior grades, and the guayule industry was fully established on a profitable basis. The rival companies, though strongly competing, were able to secure good prices and the question of a supply of the shrub became important. This led to the purchase of large tracts where the shrub was plentiful and the erection of extraction plants in many little-known sections of Mexico.

Description of the Guayule shrub. — The *Parthenium argentatum* Gray is the only rubber producer found among the Compositae. It is a woody shrub of spreading habit, naturally growing much branched. If the branches die away at the base, a distinctly treelike form is assumed. Large plants may acquire a spread or height of 3 feet or more, but such individuals are of advanced age, probably not less than 40 or 50 years old. The small leaves are greenish, silvery gray, as also are the younger twigs, which, as the age of the axis advances, change to light and then to dark ashy gray. The winter appearance of the plant is strikingly different from the summer appearance. In the winter the leaves, save those forming small clusters at the tips of the twigs, have fallen, leaving these bare. In summer the new growths are clothed with leaves of maximum size in which the green colour is more apparent. At this time the flowers are borne in loose clusters on slender stems and crown the plant with a profusion of small yellow blossoms. These are arranged in heads, each head forming at most 5 seeds; usually some of these do not develop.

A plant that is not a rubber producer, the mariola (*Parthenium incanum* H. B. K.), often grows side by side with the *argentatum* and is mistaken for it. Quite recently another species, discovered by Prof. F. E. Lloyd, has been named *Parthenium Lloydii*.

Rubber content. — Guayule is distinct from most other rubber-producing plants in that its bark contains no latex, rubber being in the cellular tissue of the epidermis and to a small extent in the branches and leaves, the blossoms being without traces of rubber. The amount of rubber in the topmost branches is very slight, but increases toward the roots. The bark also contains resins and essential oils, which decrease the value of the rubber. Fairly dry plants subdivide into the following weights:—

	Per cent.
Wood	47.0
Bark	44.5
Leaves	8.5

According to Wittlesey, guayule plants contain rubber as follows —

	Per cent.
Trunk bark	21.4
Root bark	19.5
Branches and leaves	9.7
Trunk wood	Nil
Root wood	1.7

The yield of marketable rubber from the wild plants varies according to the condition of the plants and the process of extraction employed. The extraction runs from 6% for experiments with average Texas guayule to 15% for some of the highest grade of Mexican, a fair average yield equaling 12% of the weight of the moderately dry plant.

Habitat and parasitic enemies. — Guayule at its best is found growing on the central Mexican plateau in great quantities. The district is nearly

rainless and is very sparsely populated by a race partly Indian, partly Spanish. The region is practically grassless and contains no large trees, being a typical desert country. The alkali earth which is found over most of the plateau is in reality a rich soil, needing only sufficient water to make the region a very fertile one.

The guayule is indigenous in a comparatively small area in southwestern Texas and northern Mexico. It may be bounded as follows: From the western extremity of Presidio County, Tex., the line runs somewhat west of south till it reaches the northern boundary of Durango, Mexico, near Santa Barbara, Chihuahua; then southeast parallel with the Mexican Central Railway about 100 kilometers (62 miles). Beyond the State of Durango the boundary runs still farther east, curving northward again not far from San Luis Potosi. The one hundred and first meridian marks roughly the eastern boundary; lying somewhat west of it till beyond Saltillo, where the line then curves slightly west of north, reaching the eastern limit in Texas at Langtry. The northern limit is marked approximately by Fort Stockton. The total area is about 130 000 square miles, a large part of which is in the Chihuahuan Desert. This area varies in altitude from 2 000 to 10 000 feet above sea level, and the most important acreage is not much above 6 000 to 6 500 feet.

According to Lloyd, guayule has few parasitic enemies either vegetable or animal. Amongst the former are *Puccinia parthenii* and dodder (*Cuscuta* sp.). Of the latter there are Coccidae that attack the tap root. There is also a scale, *Targionia dearnessi* Ckll., which attacks roots. The leaves are sometimes attacked by a gall insect, and there is a bark-boring beetle, the *Pityophthorus mericans* Bland.

Supply. - Although the more important guayule districts command good railway facilities, there are large areas whose exploitation is difficult on account of the lack of means of transportation. These difficulties are mainly due to the fact that water for the pack animals can not be found on these desert lands. The gathering is done under contract by natives, who simply pull the plant and load it on the back of burros.

The price of dried guayule plants, including charges began at \$ 7.50 a ton. Later, when several competing enterprises erected factories the price rose to \$ 15 and \$ 20 per ton, according to the distance between the places of origin and the station or works. During the "boom", growing guayule was bought unharvested at \$ 30 gold per ton in the field and up to \$ 50 gold per ton delivered at the factory. A fair average of the cost of guayule shrub to the leading concerns was about \$ 30 gold per ton c. i. f. factory, allowing for shrinkage until used, which must be within 60 days of cutting to prevent deterioration of the rubber. Calculating the high cost of coal and water, it was estimated that the rubber could be extracted and freighted to New York and sold there at a cost of 20 to 25 cents per pound. This included all costs, taxes, travelling options, office expenses, etc., but not royalties on processes used.

The supply of guayule in its territory is very unevenly distributed. In most parts the plants are isolated, growing sometimes in large and often

in small numbers among other plants on mountain inclines rich in lime. At rare intervals small tracts are found where it predominates. According to Endlich in the area of 75 000 square kilometers, comprising the districts where the guayule plant is principally found, ¹/₁₀ actually contains a supply; this would mean a territory of 750 000 hectares, and figuring the output as one-half ton per hectare a total supply of 375 000 tons is attained, which, at the rate of 7-10 % rubber, represent a total of 26 250—37 500 tons of rubber. In 1906 a number of experts figured out the amount of guayule shrub available for extraction, the estimated total yield of shrub being 300 000 metric tons and that of rubber 33 metric tons, which at a selling price for crude rubber of 45 cents gold per pound would represent a profit, excluding royalties, of \$ 14 520 000.

Regrowth. - - In the first collection of the guayule shrub the plant was uprooted; to a certain extent some roots were broken off and formed new growths. If, however, instead of being pulled up the plant is cut off under the surface of the soil, the root that remains will, if rain falls within a reasonable time after the cutting, reproduce a good plant. The self-sown seeds grow slowly, several years showing only a thin ¹/₄ lb. bush. Natural reproduction in the field therefore takes place in two ways, by seeds and by means of shoots which start up from the shallow-lying roots. "Retones" are relatively few in number, but their initial growth is rapid and they quickly produce flowers. Even the remaining portion of roots broken off where the plants are uprooted frequently produce new plants, and this after dying back quite a distance. Thus with reasonable care the existing guayule fields may be preserved.

Extracting Processes. - - The problem of extracting the rubber from *Parthenium argentatum* was solved by two methods, chemical and mechanical. The chemical processes are the Bergner, the Marx, the Delafond and others. The Laurence process, which was suggested by the native method of chewing the rubber out of the shrub, is the successful mechanical extraction process.

Characteristics of the rubber: Guayule rubber is not of the highest grade; its colour when new is a pale gray green, but blackens on exposure to the air. Disadvantages of guayule rubber are the amount of resin it contains, about 20 % and, due to the careless method of extraction employed by some factories, a certain amount of woody fibre; with two-thirds of the resin removed, it is very like high-grade Panama rubber.

There are ordinarily two grades put upon the market. The common grade, known as "hule crudo" (crude rubber), has the following distinctive features: - - The colour of the cut, which varies between light and dark gray; the presence of wood particles; and a resinous odour and somewhat pitchy appearance. The better grade, "hule refinado" (refined rubber), the price of which is about 20 % higher than that of the former, contains no wood and but little resin and is lighter in colour. Special brands are prepared for specific purposes and are usually more or less deresinated.

Resin is not seriously objected to in raw rubber (many African sorts with 20 % and over of resin give good results in manufacture), yet the resin

in the guayule is a disadvantage, as the rubber is itself soft and the 20 % of resin makes it still softer. The drying of guayule is difficult, as it retains moisture with great tenacity. It was at first difficult also to remove the distinctive aromatic smell, and the presence of the wood fibre prejudiced manufacturers against it.

The price of guayule rubber is dependent to a large degree upon the price of high-grade rubber. The following figures are the average of high and low prices on the best quality of guayule rubber, 20 % moisture guaranteed : —

1910	\$0.85 1/2	1914	\$0.41
1911	\$0.58 1/2	1915	\$0.20 3/4
1912	\$0.56	1916	\$0.44
1913	\$0.48 3/4	1917	\$0.38

During the calendar year 1907 it is reported that Mexico exported 11 487 678 lb. of guayule ; these figures are not official. In fact, no separate official figures were given for the exportation of guayule until the fiscal year 1910-11 ; prior to that year they were included with Castilloa rubber. The total exports of rubber (guayule and Castilloa) since the year ending June 30, 1903, were as follows : —

	Pounds.		Pounds.
1903-4	677 758	1907-8	12 372 241
1904-5	1 093 169	1908-9	13 233 382
1905-6	3 190 548	1909-10	17 750 181
1906-7	10 321 247		

Before the commercial extraction of guayule was established in Mexico, that country rarely exported over 400 000 lb. of rubber ; therefore, of the above amounts, all over 600 000 lb. may be considered guayule. The exports of guayule since 1910 are given as follows : —

	Pounds.		Pounds.
1910-11	19 749 522	1913-14	1 475 804
1911-12	14 238 625	1914-15	5 811 849
1912-13	10 218 191	1915-16	2 816 068

Cultivation. — From the time the guayule-bearing areas were fairly well located, the question of cultivation was frequently brought up. Indeed several companies employed botanists to study the plant and to conduct experiments to determine the practicability of its propagation on a commercial scale.

The German experiments in Africa were not successful ; the story of the American experiments is very different. The guayule cultivation experiments in Mexico were abandoned, not because of failure, but because of unsettled conditions in that country, and the field of operations was transferred to the United States.

The present plantation is in an upland desert, at an altitude of 2 500 feet. Of the 9 000 acres, some 1 500 are already planted to seedlings.

The plantation possesses a huge cement irrigation system, the pipes for which are made on the grounds. It has a laboratory, greenhouses for seed experiments, bungalows for the officers, excellent quarters for the help, planting and cultivating machines, tractors, etc.

Two problems had to be solved: obtaining a supply of vital seed and speeding up the crop. The first problem was solved by an accident, the second by experiment, so that the development of guayule which under natural conditions had taken 15 years was accomplished in 4 years, beating first-crop Hevea by two years. By the study of varieties of guayule shrub, of which there are 900 types, and of the quantity and quality of their rubber content the big and best producers were selected, and by hybridisation of the big producers with the best producers plants were obtained that had the good qualities of each. Therefore, with the big and best producing seed stock the real cultivation of guayule was on the way to success.

Solving the labour problem. — In an age when almost everything is done by machinery, the growing of india-rubber, particularly the tapping and the gathering, is hand-work entirely. Without large gangs of coolies the production of india-rubber in any considerable amount seems impossible. With the cultivation and the collection of guayule rubber, however, machinery takes the place of men in almost every part of the work. The preparation of the fields is done by disc harrows, drawn by tractors. The planting is done by specially built machines, similar to tobacco planters, that plough four furrows, set the plants at the proper intervals, cover them, and pack the earth about the roots. One machine plants 18 acres a day. The cultivating is also done by machinery. For gathering there are two systems: one consists in cutting the rows down by a harvesting machine; the other in ploughing the plant out root and all as in the harvesting of sugar beets. The extraction of rubber is wholly mechanical. If the rubber is desinated, that also is done by a mechanical process.

Guayule growing on a large plantation involves a laboratory for examining and testing plants and product, a small greenhouse for seed experiment and hybridisation, seed beds protected by wind breaks, an irrigation system, planting and harvesting machinery, and an extraction plant; but above all, it requires a knowledge of the plant itself and plenty of capital.

321 **On the *Mascarenhasia* of Eastern Madagascar.** JUMELLE, H. and PERIER DE LA BATHIE, H., in: *Annales du Muséum colonial de Marseille*, Vol. XXVI, 304 Scies., Vol. VI, pp. 15-20, Paris-Marseilles, 1918.

To the north of Vohémar, where the vegetation is much the same as in the north-west, and especially of Sambirano, the three species of *Mascarenhasia* which grow at the same time as *Landolphia Perrieri* are *M. arborescens*, *M. angustifolia*, and *M. lanceolata*. To the south of Vohémar appears the characteristic vegetation of the eastern side. Between Tamatave and Farafangana especially, the authors noticed: 1) the variety with large follicles (var. *coriacea*) of *M. arborescens*, which occurs as a type under

two large forms, *anceps* and *longifolia*, both called "herotrahazo", "babo" or "valley hazondrano", according to the district; 2) *M. mangorensis*, also known as "babo" and, at Analamazoatra, "hill hazondrano"; 3) a species also called "herotrahazo" which, before knowing its flowers, the authors called "large-leaved Mahazoarivo Mascarenhasia", and, now that they know the flowers, *M. rubia*. This last species is not found only at Mahazoarwo, in the Matitana basin, at a height of about 574 ft., where it was first observed, but also much further north, in the woods of the Anove basin, where it is called "gidroamena" and "barabanjamena, and at Marambo (Masuala), on the Antalaha slope, where it is known as "barabanjantanety" and "hill baranbaja". It seems to grow as a rule to an altitude of about 650 ft. in rather dry woods, neither near the banks of the water courses nor the marshes.

The variations in these rubber plants of Madagascar are so complex that each new observation complicates rather than simplifies the problem; this is proved by the following fact. The authors report a tree having a trunk of from 33 to 50 ft. (it is true they cannot affirm it was a *Mascarenhasia* because they did not see its flowers) growing at a height of 1640 ft. in the woods of the Bay of Antongil. Only the underground parts contained rubber. The aerial parts only contained a liquid which, on evaporating left a brown substance, soluble in water, lathery like soap, and rather similar to that found in *Alafia* milk. It is a unique example.

STIMULANT,
AROMATIC,
NARCOTIC AND
MEDICINAL
PLANTS

322 · Cultivation of the Robusta Types of Coffee in Ceylon. DEVIROM, H. A., in *The Tropical Agriculturist, Journal of the Ceylon Agricultural Society*, Vol. LI, No. 4, pp. 218-221 + 2 Figs. Peradeniya, Ceylon, October, 1918.

The *robusta* coffee tree, a native of the Congo, is today grown on a large scale in Java, whereas the *canephora* coffee tree has spread rapidly in Madagascar. The varieties of the *robusta* type now cultivated at the experiment stations of Peradeniya and Annadhapura are *robusta*, *canephora*, *uganda*, and a hybrid obtained by M. M. Leoben frères, Paris (1); young Javanese plants have also recently been cultivated and will shortly be planted out. The *robusta* coffee plant has also given good yields at the Balangoda Demonstration Garden of the Agricultural Society, and has been planted in the Kegalla Demonstration Garden.

Coffea robusta prefers wet districts and fears the wind, it must be sheltered from the sun by shade trees and protected from the wind. *C. canephora* prefers greater altitudes than those suited to *C. robusta*, and seems more able to resist drought. *C. uganda* is recommended in Java for poor and old, exhausted soils. The *C. robusta* type likes deep soil, preferably loamy but the plants are strong and can grow in all ordinary good soil sufficiently

(1) It is perhaps not out of place to point out that all workers do not agree entirely in their classification of the species and varieties of the *Coffea* genus. M. E. de WILDEMAN (Curator of the Royal Botanical Gardens at Brussels) says in his work entitled *Les Plantes tropicales de grande culture* (note 1, p. 140): — "The systematic division of this interesting genus is far from finished, in fact it may be said to be hardly begun". (Ed.)

rich in humus. Heavy clay soils are usually not suitable and the proportion of clay must never be such as to prevent satisfactory drainage. The most favourable climate in Ceylon for *robusta* coffee plants is found between an altitude of 1 000 ft. and 5 000 ft. Experiments made at Colombo and Anuradhapura show, however, that these plants may be grown at low altitudes. They can resist fairly severe drought but prefer a regular and ample rainfall. Very hot climates do not suit them and they do not do well exposed to wind.

The cultivation of coffee is then described, the nurseries, preparation of the soil, and planting being dealt with successively. The most usual spacing is 6×6 ft., but observations made at the Experiment Station show that this should be 8×8 ft., or even 10×10 ft. When grown between rubber trees the coffee trees should be planted in rows 6 ft. away from the lines of trees and at distances of 8 ft. between each plant in their own lines. When grown between coco trees 30×30 ft. apart, they should be planted in lines 8 ft. from the coco trees and at distances of 7 ft. between each plant in their own lines.

In Ceylon coffee has hitherto been grown without any shade, whereas in Java, South India, etc., it is cultivated in the shade. When slightly shaded it is less subject to diseases of the leaves. The Peradeniya experiment plantations have shown in a striking way the value of light shade to the coffee plant, and it should be possible profitably to grow plants of the *robusta* type over a large area at Ceylon if sufficient attention be given to shade. The shade trees used at Peradeniya are *Leucaena glauca*, *Erythrina lithosperma* ("Dadap") and *Gliricidia maculata*. All three are Leguminosae which may be recommended in all confidence; *Leucaena glauca* is considered the best shade tree.

The author discusses topping (between the 2nd and 3rd years, when the plant is 5 to 6 ft. high its top is cut to 4 to 5 ft. above the soil), pruning and the attention to be given to young plantations, fertilisers, catch crops, yield (the yield varies greatly according to the soil and climate, but is, on an average from 1 to 5 cwt. per acre. At the Peradeniya Experiment Station the hybrid coffee plant appears to be more productive than the *robusta*; its fruit is smaller and gives a yield of 20 % of dry coffee. The preparation of coffee, diseases and pests of the plant and the methods of controlling them are also described.

323 - **Tea-Growing in the Caucasus** (1). — TITCHEBAULT, V, in the *Journal d'Agriculture pratique*, N. S., Vol. XXXI, No. 26, pp. 10-512. Paris, December 26, 1918

This paper was written before the Russian revolution. The climate of the central and southern river districts from the Black Sea to the Caucasus make these sub-tropical districts very well suited to tea-growing. The average winter temperature for Batumi, Poti and Sukhum (6.5°C), the abundant rainfall (1250 mm. for Sukhum and 2 370 for Batumi), and the red clay soil ("etzeri" in Georgian) similar to that in which tea is grown in China, are all favourable to this crop.

(1) See R. Jan. 1912, No. 118; Dec., 1912, No. 1313; Jan., 1916, No. 51 (Ed.)

The importation of tea into Russia which as early as 1880 was of a value of 40 million roubles (1) had drawn the attention of specialists. In 1884, Colonel A. SOLOVKOFF, who owned land at Tchakwa, near Batum, planted tea plants imported from Shanghai (2). As the crop proved to be of good quality, K. S. POPOFF, the tea merchant, and the Imperial Apanage planted in 1893 experimental tea fields near Tchakwa. Plants and seed of the best varieties were brought from China by Prof. TIKHOMIROFF, and later M. KLINGEN and Prof. KRASNOFF went to India and the Far East to study the tea industry and bring back the best plants. Towards 1900 the tea plantations covered about 990 acres, of which 305 acres belonged to the Imperial Apanage, 247 to M. POPOFF, 55 to M. SOLOWITZOFF, and the rest to MM. VOUTCHINO, STOIANOFF, BOUKOWITZ, Prince MACACHIDZE etc. They were all in the neighbourhood of Batum and Zougldidi.

The plantations were made with two-year old plant. or seeds, with 2 430 to 3 240 plants an acre. In addition to digging the soil to a depth of from 15 to 20 inches, nothing is done beyond weeding and pruning. Harvesting is begun when the trees are 4 to 5 years old, and is complete when they are 6 to 8 years old. The leaves are picked in four times by women and children who gather from 18 to 22 lb. of green leaves per head daily. One acre yields from 700 to 1 400 lb. of green leaves or 200 to 350 lb. of dry tea. After desiccation the tea is pressed by hand, after the Chinese manner. Large growers (Imperial Apanage, POPOFF, etc.) have machines. Both green tea and black tea are prepared, the second by fermentation. Sorting is done by hand through a sieve, or by machine, through cylinders. The cost of preparing tea for the Imperial Apanage was 1s. a kilogram (2.2 lb.), and the tea was sold at 3s. 2d to 4s. 9d. the kilogram. The profit per hectare from the first plantations, including the cost of cultivation up to the 6th year was (deducting the partial crops from the 4th to 6th year), 1 200 to 1 500 roubles, not including the cost of the land and administration.

In 1900, the Department of Agriculture planted 25 experimental fields in the Koutais province, but, according to M. TIMOFÉEW, there is little chance of obtaining good results in central Imeretia where rain is less plentiful. Success is, however, certain in all lower Imeretia, round Batum, from Sukhum to Tsebelda, and in the Kodov, Samourzakane, and Zougldidi districts. M. POPOFF brought over 15 Chinese workmen to teach the natives this new agricultural industry, the success of which is assured.

As early as 1906, after 5 years' experience in experimental fields, many private people in Gouria and Mingrelia made plantations. In view of the labour necessary for picking, plantations of 1 to 2 ½ acres which can be looked after by one family are most profitable. In the land owned by each village there is nearly always some of the red soil so favourable to tea and

(1) 1 rouble = 25 1d. at par.

(2) According to M. S. TIMOTZOFF the first attempt was made by Prince VOROUZOFF, who in 1880, had tea plants sent from China for the Imperial School of Nikita, in the Crimea; in 1888 these plants were taken to the Botanical Gardens of Sukhum and Zougldidi, belonging to the Prince Regent of Mingrelia. (Author)

of no value for maize ; such land is not worth more than 11 to 20 *roubles* an acre. In 1906 the area planted was over 1 100 acres.

In China, India and Ceylon the plantations are attacked by numerous insects and fungi. With the exception of one slightly injurious fungus, *Pestalozzia Guepini*, the Batum fields are free from all disease and insect attack.

In 1909 the plantations, covering 1 490 acres, yielded about 211 000 lb. of dry tea (1). In 1910 the acreage was 1 510 acres, including 990 belonging to the Imperial Apanage 260 to M. POPOFF, and plantations of from 17 to 25 acres and over 60 of less than 2 ½ acres. The crop was 589 600 lb. Tea from China, Japan and Ceylon is grown but the Imperial Apanage has decided to plant only Chinese tea, which is of better quality. In 1910 there were six factories belonging to the Imperial Apanage, and to MM. SINIZINE, DIADOUCHA, VERDEREVSKI, MAKACHIDZI, and POPOFF. The factories pay 16 *kopeks* a lb. for green tea and charge 32 *kopeks* for preparing it. Small growers do the work by hand, but lack of capital prevents this industry from developing. In 1910, from 209 000 to 220 000 lb. of dry tea were prepared in 200 to 400 grammé packets, sold, according to quality from 73 *kopeks* to 3 *roubles* 65 *kopeks* the pound, with a deduction of 6 to 30 % to retailers. The cash profit made by the Imperial Apanage is 200 *roubles* per acre.

According to the sampling of experts and the analyses of MM. DEMIDOFF and two chemical laboratories of Petrograd, Caucasus tea is not inferior to the best Chinese teas ; it is very delicate, has a soft flavour and pleasant smell and gives a very strong infusion. Unfortunately as the private factories are insufficient to prepare the tea of the small growers it is prepared by hand and prepared much less well than that of the Imperial Apanage or the firm of K. S. POPOFF, and is, consequently, of inferior quality.

In 1904, when the area under tea was 2 100 acres (1 235 belonging to the Apanage, 495 to the firm of POPOFF and 370 to small growers), the Department of Agriculture, at the request of the Society of Agricultural Economists of Batum, made a grant of 15 000 *roubles* to establish a local factory for small growers owning up to 125 or 150 acres.

At the present time the area planted has hardly changed. It should, however, be noted that in Gouria (district near Batum, the chief locality of which is Ozourghetti), the inhabitants of which are said to be the most industrious and most active in the Caucasus, during the last two years, in spite of the war and their proximity to the Teborok front, 102 peasants have planted nearly 100 acres in 31 villages. This makes it possible to foretell a brilliant future for tea growing in the Caucasus, especially if subsidies are granted the inhabitants, who are mostly poor, though all possess a small piece of ground (2).

The production is now from 264 000 to 270 000 lb. of dry tea, sold at Petrograd, Moscow, Warsaw, Kharkoff, and other towns at 2.40 *roubles*.

(1) Part of these 1490 acres was then not yet yielding. (Author)

(2) In 1916, the area planted was 2316 acres. (Author.)

1.60 roubles, 1.20 roubles and 46 kopeks per 400 grammes, according to quality. The demand is so in excess of the supply that tea can rarely be found on sale in the Caucasus.

Russia imports annually 154 000 000 to 165 000 000 lb. of tea. The area of good land suitable for tea growing is estimated at 98 800 acres. According to Prince MARACHIDZÉ 49 400 acres of grey, clay, or light sandy clay forest land which could produce good tea of second quality, may be added. Vast areas could be planted in districts where tests have given good results. At the rate of 280 to 300 lb. of dry tea per acre, this would yield 44 million pounds, or 20 to 25 % of the quantity imported into Russia. Prof. OZEROFF believes that in the Koutais province there are 358 000 acres of land suitable for tea-growing (on the coast of the Black Sea, Batum, Ozourghetti, Sokhum, Isébelda). If these were planted it would be possible to produce half the quantity consumed in Russia. The Government has taken steps to encourage this industry and has already established a factory and distributed seed free of charge. This is, however, little in comparison with what the private initiative of capitalists and financial establishments might do after the war.

324 - On the Cultivation of the Cacao Tree in Madagascar. — BORGRAUD, A., in the *Revue Agricole et Vétérinaire de Madagascar et Dependances*, Year III, No. 23, pp. 387-402, Tananarive, September, 1918.

Study presented to the Congress of Colonial Agriculture held in France in 1915 by the author (President of the Agricultural Committee of Tamatave, Madagascar).

In his report the author deals more particularly with the cacao tree on the east coast of Madagascar, especially in the Ivondro and Ivoloina districts. He is of the opinion that the crop in question would be grown on the largest scale in those districts, as the alluvial soils of the valleys are perfectly suitable, the maximum temperature is 36°C., the minimum temperature is 30°C., the minimum temperature 14°C., and the mean temperature is 24-27°C., while the height of water is from 2.50 to 3 metres annually.

Many cacao plantations had been laid down in the Ivondro and Ivoloina districts before the experimental gardens of Ivoloina had introduced the cacao tree from the Antilles about 1904. The only cacao tree grown at that time was the "Criollo" variety, imported from Reunion about 1880. The planters were not satisfied with this variety as it was of slow growth (requiring 6 to 7 years for its first crop) and gave a poor yield (300-500 gm. on an average for mature trees). In consequence they began to plant the cacao tree from the Antilles.

About 1909, a kind of canker appeared on the branches of the new cacao trees growing in the Ivoloina valley, and, in spite of the use of remedies, the disease continued to spread, so that plots containing several thousands of 4- to 5-year-old trees were cleared in the space of a year.

After this catastrophe, the Liberian coffee plant, which is more hardy, was cultivated instead of cacao.

In the Ivondro district, however, the same disease began to appear

about 1910. On account of the poor results given by remedial treatment all the diseased trees were dug out, burned, and replaced by fresh plants. In this way the cacao plantations were preserved, and have since given crops that were, if not extraordinary, at any rate reasonable.

Besides the set-backs due to disease, there is another that not only delays the spread of cacao growing but also hinders that of most of the other crops of the east coast region. This is the irregularity of labour, as the natives of that region are naturally lazy. A carefully thought-out series of regulations is needed in order to make them work (e. g. - the individual "registration card", together with an enquiry into the means of sustenance of each native, etc.). The author thinks that only the European is suitable for taking up cacao planting, and even he must be daring, courageous and persevering, while disposing of a certain capital, if he wishes to obtain results. According to the author, the native, generally speaking, even if owning the necessary capital, will never be able to wait 5 years to gather his first crop.

The author deals with the question of the amount of capital required, then considers cultural conditions regarding the soil, climate, labour, the formation and upkeep of the plantation (seed plots, shade crops, pruning, manuring and fertilising), the control of diseases and pests, and harvesting. He next studies the industrial and commercial questions relating to the preparation of cacao (fermentation, drying, washing, claying) and the qualities of the different cacaos (well prepared products from the east-coast region of Madagascar have always been thought well of by chocolate makers both in France and in Reunion and appear to give complete satisfaction).

325 - **Production of Korean Insect Powder.** C. REICH, R. S., in *Commerce Reports*, No. 163, p. 166. Washington, D. C., 1918.

Authorities of the Government General estimate Korea's production of chrysanthemum powder in 1917 at 900 lb., with an additional 330 lb. of the dried flowers, unground. In their opinion this quantity could be much increased in the future were sales contracts made for the product, in which event they place the probable output of powder and unground flowers at:—

Province	Dried				Powder			
	1918	1919	1920	1921	1918	1919	1920	1921
North Chusei . . .	—	—	—	—	300	300	300	300
South Chusei	1 240	2 315	3 140	—	—	—	—	—
North Zema . . .	—	—	—	—	1 210	1 210	1 210	1 210
North Kisho	100	100	100	3 430	1 040	1 040	1 040	1 040
Total	1 860	5 050	7 520	3 430	2 550	2 550	350	2 580

The variety used in the *Chrysanthemum cinerariaefolium*.

326 **Culture of the Globe Artichoke; Experiments in New York State; U. S. A.** — WILKINSON, J. W., in the *New York Agricultural Experiment Station Bulletin* No. 435, pp. 311-319, Geneva, May, 1917.

This bulletin contains:— a botanical description of the artichoke (according to the *Index Kewensis* it is considered as a variety of cardoon

HORTICULTURE

[*Cynara Cardunculus*], and not as a species [*C. scolymus*]); history (it was not eaten by human beings before the 15th century); varieties (not yet well defined; DE VILMORIN mentions 13); cultivation; protection against winter (covering the plants from November to the first days of April with coal ashes; covering the plants with manure was tried at the Geneva Station, but caused the centre of the plants to rot); uses as food.

Since 1913 the Geneva Station has cultivated many artichokes and has observed the variations occurring in the different varieties. The yields of 50 plants observed in 1916 are given in a table. The number of artichokes (floral buds) produced per plant varied from 0 (in several cases) to 18 (in 2 plants). This shows that multiplication by suckers is the most satisfactory method to maintain the varieties in a condition yielding abundantly both fine plants and fine artichokes.

FRUIT GROWING

327 - **The Best Varieties of Fruit to Grow in Ohio, U. S. A.** — GREEN, W. J., THAYER, P. and KEIT, J. B. in the *Ohio Agricultural Experiment Station, Bulletin* 313, pp. 603 691 + 1 Plate. Wooster (Ohio), March, 1917.

Lists and descriptions are given of the varieties of apples, pears, plums, peaches, cherries and small fruits considered as the best to grow in Ohio. The lists are based on experience gained during 25 years in growing the fruit in the orchard of the State Agricultural Station and in the orchards cooperating with this Station, as well as on studies and observations on certain fruit growing problems made in various parts of Ohio.

328 - **Seed Production in Apples, in the United States.** — CRANDALL, C. S., in the *University of Illinois, Agricultural Experiment Station, Bulletin*, No. 203, pp. 185 213 + 8 Figs. Urbana, Ill., August, 1917.

As a preparatory work to the study of the production of pips by apples the author counted the pips in 31 972 fruits representing 32 cultivated varieties and 25 botanical species and varieties of the genus *Malus*, belonging to the following four groups: 1) large apples of varieties grown in orchards; 2) small apples of varieties grown in orchards; 3) crab apples; 4) fruit produced by hand pollinisation.

The average number of pips found was 8.27 in large orchard apples, 7.21 in small orchard apples, and 4.22 in crab apples. In each variety or form, however, the actual number of pips sometimes differed greatly from the average number. Differences in the average number of carpels were found in both the cultivated and crab forms, but were more frequent in the second. The several varieties and species differed considerably in their capacity for producing pips, the numbers of which varied greatly in the different fruits of the same trees. The number considered as normal — 10 pips per fruit — was found in only a small percentage of orchard apples and but rarely in crab ones. The capacity for producing pips appears to be a character inherent to the variety. Parthenocarpic fruit are found in the orchard varieties and in some of the *Malus* species, but are not numerous. There is great irregularity in the appearance of a normal number of ovules (2 per carpel). Cases of suppression of the ovule are rare; an excess in relation to the normal number is more common in

cultivated forms than in wild ones. A comparison of the production of pips in fruit from flowers pollinated by insects and that from flowers pollinated by hand, showed very slight differences. Pip production does not, therefore, appear to depend on the way pollinisation is carried out. There are considerable differences in the number of pips between each fruit and each variety, but the averages of the groups show that, in the most improved orchard varieties, the number of pips is about double that of wild apples, and that large fruit contains more pips than small fruit.

FORESTRY

329 - **Tests of Western Yellow Pine Car Sills, Joists, and Small Clear Pieces.** — **AMERMANN, C. W.**, in *U. S. Department of Agriculture, Bulletin* 497, 16 pp. + 1 Fig. + 2 Tables. Washington, D. C., April V, 1917.

Western yellow pine, *Pinus ponderosa*, is distributed over the greater part of the Western United States, but reaches its best development in California. A variety of the species, known as *scopulorum*, occurs in the Rocky Mountains.

In the bulletin under review tests of the mechanical properties of western yellow pine, with special reference to its use as a structural material, are reported. The following conclusions are drawn:

The strength values of structural timbers are influenced considerably by the defects found in them. These values vary according to the grades in the green material, but the increase in strength from air seasoning is not uniform and does not vary with the grades. Seasoning greatly increases the strength of the wood, the increase being greater and more uniform in small, clear sticks than in structural timbers, owing to the development of defects in the latter. Lowering the moisture content of yellow pine causes it to become more brittle. Western yellow pine is a lighter wood than the other western lumber species, weighing approximately 26.9 lb. per cubic foot, oven dry, in structural sizes. The dry weight of clear wood readily suggests its strength or weakness, but this factor alone can not be depended upon to indicate comparative strength when structural forms of various grades are taken into consideration, owing to the presence of defects which have an important influence on their strength.

A table comparing the strengths of various western species (Port Orford cedar - *Chamaecyparis lasiocarpa*, Western red cedar - *Thuja plicata*, Amabilis fir - *Abies amabilis*, Douglas fir - *Pseudotsuga taxifolia*, Noble fir - *Abies nobilis*, Western hemlock - *Tsuga heterophylla*, Western larch - *Larix occidentalis*, Sitka spruce - *Picea sitchensis*, Western yew - *Taxus brevifolia*), based on tests of small specimens, is given.

LIVE STOCK AND BREEDING.

HYGIENE

330 - **On a Babesiosis due to *Microbabesia divergens* in the Dutch East Indies.** — **SOMERS, J. C. F.**, in the *Verhandelingen Medische Maatschappij (Departement van Landbouw, Nijverheid en Handel)*, No. XXVIII, 75 pp. + 3 Pl. + Bibliography of 5 Publications. Batavia, 1918.

The small endoglobular parasites of live stock belonging to the genus

Babesia which occur in the Balkans in Finland, Germany, Holland, the United Kingdom and France are the same from both a morphological and pathological point of view. In all probability, those found in Italy, Norway and the Argentine (perhaps those found in the north of Africa and in Egypt as well) and so far more or less completely described, ought to be referred to the previous ones.

In 1917 the author discovered in live stock imported into Java from Australia a small parasitic *Babesia* which could not be identified as the one occurring in the above mentioned countries. It is clearly smaller than *Babesia bigemina* while in the peripheral blood it has an elongated form and, in the spleen and especially in the kidneys, a more contracted and voluminous form which is also observed, in most cases in *post mortem* blood. The geminate forms seen in the peripheral blood often separate then come in line on a single horizontal axis. This parasite was already known under three names *Babesia bovis*, *B. divergens* and *Pinoplasma arcentinum*, in order to obtain simultaneous expression of its two characteristic properties small size and divergent shape the author proposes to call it *Microbabesia divergens*.

The first symptoms of microbabesiosis (known also in French, as divergentiose) differ little from those of Texas fever, on the contrary however after death the bile appears like apricot jam in the first case while it is thick and greenish in the second. Hemorrhagic infarcts of the kidney were found in nearly every case. Splenomegaly appears to be a characteristic symptom of microbabesiosis which however does not cause such severe losses as Texas fever.

The inoculation of *Microbabesia* only produces a slight infection followed by immunity. According to MACLEODIAN and STOCKMAN Texas fever and microbabesiosis do not give reciprocal immunity, on the contrary, IRWIN states that *Microbabesia* confers absolute immunity against *Babesia bigemina* whilst the latter species only gives partial immunity against *Microbabesia*. If this is true it will no longer be necessary to have recourse to inoculation by *B. bigemina* since that with *Microbabesia* which is much less dangerous will suffice. In Java the intermediary host is *Bouphalus australis*.

According to VON HILFENS and NOSOWI quinque bisulphate is of use at the onset of infection only, trypanobluce appears to be inefficient, but ichthican is perhaps better. Infected livestock should be put in the hyppos.

The infection has come to Java from Australia, for this reason the author recommends that the animals should be dipped before and after sailing, the ships used as cattle boats and the cattle pens should also be disinfected and not simply treated with stram.

331 On the Treatment of Distomatosis of Sheep. VILCOQ in the *Comptes rendus des Séances de l'Académie d'Agriculture de France* Vol V, No. 2 pp 54-62 Paris, January 15, 1919.

The author, Director of the Practical School of Agriculture at Chesnoy (Lorient France) describes experiments made on the school estate regard

ing the treatment of distomatosis of sheep. These experiments clearly show the therapeutic value of the ethereal extract of male fern, and lead to the conclusion that the disease due to liver flukes (whose cysts are ingested by the sheep when eating plants off contaminated, damp meadows, especially Ranunculaceous plants such as *Ranunculus lingua* and *R. flammula*), a disease which, up to the last few years, was still refractory to treatment, is curable and that recovery is absolutely sure if the animals are not allowed to become completely exhausted before treating them.

The treatment consists in giving 5 gm. of ethereal extract of male fern mixed with 25 gm. of white, edible oil on 5 consecutive days. The cost of treatment per head is as follows :—

25 gm. of ethereal extract of male fern at 150 fr. per kg.	3.75 fr.
125 gm. of white oil at 7 fr. per kg.	0.875 fr.
<i>Total</i>	4.625 francs

On adding the cost of labour, a total of 4.75 francs per head is arrived at.

332 - Sorghum Seed as Food for Pigs and Horses. — See No. 315 of this Review

333 Live stock Rearing in Indo-China. DONARCHE, *Compte d'Agriculture Coloniale Gouvernement général de l'Indochine*, Hanoi Series, No. 10 pp. 63 Hanoi Haiphong, 1928.

As it is at present, Indo-Chinese cattle rearing is far from showing an importance in relation to its possibilities. The stock are of mediocre quality and many regions, though suitable for pasturing, have a very small animal population.

In addition it is important to avoid a cause of error resulting from the simple examination of statistics: on the one hand, they are very approximate, on the other, large numbers of cattle or buffaloes are to be found in regions which in no way can be called rearing districts. Such are the great plains of the deltas, almost exclusively occupied by rice fields, and where it is absolutely necessary to have large numbers of draught or butcher's animals. The conditions under which the animals live are such that, far from prospering or developing, the stock when it arrives there, begins to waste more or less rapidly and is almost completely lost for breeding purposes, the few young stock born are weakly and degenerate.

A distinction should therefore be made between those regions producing live stock and those consuming them. The same causes produce the same effects, and that which happens at Tonkin also happens in Cochin-China and it could not be otherwise, both of these countries are really consumers rather than producers of live stock. In fact it is found that they are obliged to have permanent recourse to importation.

It will thus be seen that we must go especially to Cambodia, Annam and Laos in order to increase the production of live stock, which, of course, does not exclude the utilisation of the appreciable reserves to be found in certain provinces of Indo-China and the central and upper region of Tonkin. The object of the present work is, therefore, to consider the resources in general, to find out how they may be both utilised to the greatest degree and increased as regards quantity and quality.

FEEDS
AND
FEEDING
BREEDING

It is very difficult to estimate, even approximately, the total numbers of cattle, buffaloes and pigs, as the heads of provinces can only obtain the necessary information from the native authorities who accept with closed eyes the figures furnished by the village chiefs, who, from district or for reasons that are not always avowable, always conceal a part of the total head of live stock. There are practically no sheep.

The official figures for 1916 are given below.—

Countries	Bulls	Cows	Calves	Buffalo bulls	Buffalo cows	Buffalo Calves	Swine
Cochin-China	70 528	46 603	18 539	118 691	132 352	46 482	414 174
Tonkin	75 545	81 410	34 991	141 225	152 813	76 060	1 050 987
Annam	95 761	107 368	56 672	69 819	75 353	19 855	328 723
Laos	131 185	124 678	83 228	148 543	141 813	73 373	82 150
Cambodia	262 506	163 434	156 509	140 701	128 308	97 254	586 500
TOTALS	634 523	523 535	289 939	618 979	630 709	334 024	2 662 534

Cambodia is the only one of the countries quoted above that has a permanent and important exportation of live stock. From 1909 to 1904 inclusive, 77 082 head of cattle and 39 424 buffaloes were exported from Indo-China; account should be taken of the stoppage of exportation in 1913, as epizootics had led the Philippine Government to forbid their entry. Thus, out of 5 years' exports, there is a yearly average of 15 416 cattle and 7885 buffaloes, the greater part of which came from Cambodia. The author calculates that the total export from Cambodia was 75 000 cattle and 35 000 buffaloes.

The author (Chief of the veterinary, zootechnic and epizootic Service of Tonkin) allows that live stock in Indo-China increases by 5 to 6 % per year, in spite of a much higher birth rate.

No matter what part of Indo-China may be considered, certain risks common to all the regions must be feared for stock rearing: first come the epizootics, but the losses due to floods or drought are sometimes much greater than those due to disease.

Cattle plague is the disease most dangerous to cattle and buffaloes. Its severity varies according to the epizooty (they occur every 6 or 7 years, but small centres of infection are always being reported which are fairly easy to isolate) and, during the course of one of them, according to the circumstances at the time, the disease is very serious at the beginning of the epizooty, but its virulence gradually diminishes until it often becomes benign at the end. Buffaloes are not so resistant as cattle.

The disease is certainly endemic and the infecting organism remains in the natural pastures, where, at certain moments, it becomes virulent owing to causes which are not understood. But the most serious epidemics are those introduced from the outside by cattle coming from China. The only measure that might be efficacious would be to forbid absolutely any

importation of cattle from the exterior, and this has been done by the authorities on several occasions. But practically it is very difficult to put a complete stop to the entry of stock owing to the winding roads, wooded ravines, etc. This state of affairs can only be improved by a very complete sanitary organisation on all the frontiers.

Cattle and buffaloes also suffer from other diseases, especially true anthrax and symptomatic anthrax.

Pigs pay a heavy tribute to contagious diseases ; swine plague and pneumo-enteritis cause great losses ; cattle plague causes relatively little loss and the other infectious diseases are practically negligible.

Parasitic infections are supported in a remarkable way by live stock.

The native population seeks meat for food more and more, and the chief obstacle to the wider spread of this food is its high price. In spite of the increase of public wealth it is probable that the end of this state of affairs is not near.

Breeding is left to chance, which prevents any improvement of the stock. The education of the native remains to be begun as regards methods of breeding and improvement.

The author shows how the natives conduct rearing in Indo-China, and points out the mistakes that were made on stock farms run by European colonists who were not competent in the matter. At the present time these mistakes are no longer made, and it may be said that most of the colonists manage their stock suitably, while many are obviously progressing.

The European breeder wants to get imported breeding cattle (or, more exactly, half-breeds) of good quality native cattle, according to the nature of his farm, he would require one or the other variety ; in the large coffee plantations, which need great amounts of manure, he will require native cattle or those that are sufficiently crossed so as to have a larger frame and to become butcher's cattle with a fairly high yield ; the dairy farms require animals with one half or a quarter of imported blood, which yield more milk, but require more attention.

According to the case the planters or breeders have gone in one or the other direction as regards breeding, and sometimes both procedures are employed simultaneously.

Some breeders have imported choice stud animals from France, but so far unfortunately in too small numbers.

The imported breeds actually represented in the colony are : -- those from Australia, with or without horns ; the " Abondance " Savoyard breed introduced into Tonkin by Messrs. BOREL Bros, and which are very resistant to the climate ; the Hindu breeds, present only in limited numbers in spite of their valuable qualities. Some Breton cattle, imported some fifteen years ago, have stamped their qualities on a few descendants ; the author thinks that this breed deserved a better fate and that rational experiments would give interesting results.

These various crosses were, at first, made in order to start a dairy industry which has always been needed, and now more so than ever.

The production of butcher's animals that fatten better and have larger frames than the native animal has been attempted by some of the colonists. This aim has apparently not been attained for if the live weight has been increased, yet the degree of fattening is not better than that reached by well prepared native cattle and the trade opinion is that the meat is not satisfactory.

The breeders quite realise that they must not try to obtain products having too much Australian or European blood; animals having one-quarter of blood are the only ones that seem to allow the improvement of the breed while maintaining its natural hardiness.

Fattening is, moreover, rarely complete. It would be difficult and costly and so complete fattening is only attempted exceptionally, as in preparing cattle for a show, for example.

The colonists utilise the products at their disposal as well as they can, but the economic question does not allow them to be prodigal on this point, as the selling price does not give enough margin to allow of great sacrifices. Pasturing in places where the grass is better and a few meals of cooked grains or sweet potatoes, make up the elements of their fattening, which suffices to satisfy the European consumers. It may be added that, in the case of mature but not old animals, castrated early and prepared as described, brought to the abattoir by short stages and in cool weather, the meat, though not as choice as that of European breeds, is fairly tender and of agreeable taste.

From what has been said as regards the importance of the available stock and their increase in numbers, it will be seen that, in the present state of Indo Chinese breeding, neither Cochin-China nor Tonkin can furnish stock for export purposes; their requirements are greater than the production and the percentage annual increase is too small to be able to counterbalance the lack for a long time.

The resources of Laos are said to be important and the extent of the pastures in that country tends to confirm it. But the information is of uncertain value and no definite conclusions can be drawn.

Annam might possibly provide some exports, but these would be limited by the large demand from Tonkin which will, it seems, continue for the present.

More precise information is available for Cambodia; this country can export a considerable number of cattle and buffaloes. The maximum reached in 1910, a year in which 31 594 cattle and 15 965 buffaloes were sold to the Philippines, does not appear to have surpassed the export capabilities of the country since, in 1911, 22 184 cattle and 11 567 buffaloes were sent to Manilla. The average exportation may be equal to that of 1910 for cattle and considerably higher for buffaloes.

The yearly average number of pigs that could be exported from Indo-China, is according to the author, from 30 000 to 35 000 head.

The chief quality of Indochinese stock is its hardiness, no matter what species be considered, which is of the greatest importance given the influence of the environment. But this valuable quality is incompatible,

unfortunately, with certain improvements or specialisations; the so-called improving crosses, which exaggerate certain functions, are in this respect the most injurious to general organic resistance. Therefore this should be taken into account.

The author gives details regarding the qualities of the stock, the yields in meat, the prices of meat and live stock, present-day difficulties of trade, sales, markets, movements, transportation, exportation, the way to arrive at the necessary improvements, the possibilities of trade with France or other countries. As regards the latter point of view, trade in live stock cannot be established between France and the colony; it can only be carried out with the Far East, whose nearness makes transport possible; trade with France can only be done with frozen or preserved meat.

Sheep practically do not exist in Indo-China and there is little possibility of their becoming important; thus no wool is or will be produced.

The trade in raw and prepared skins and hides is already of importance and will have a certain future.

The author gives general considerations relating to the pastures, forage reserves and crops directly related to stock breeding.

He concludes by expressing the wish that the Government of Indo-China will do all that it can to introduce the best breeds for improving the native stock into the country; buying and shipping a few hindoo bulls and cows would not lead to any great expense; these animals, kept in the breeding establishments of the Protectorate, would permit a pure-bred herd to be built up as well as crossing with the native breeds. The comparison of the results obtained by these two parallel procedures would show the best way to follow. It would then be possible to provide owners whether European or native, with breeding animals well suited to local needs and of such a nature as to bring local breeding to an interesting degree of perfection.

334 Feeding Work Horses; Investigations in Kansas, U. S. A. — McCAMPBELL, C. W., in the *Agricultural Experiment Station, Kansas State Agricultural College Circular No. 62 (Bulletin 186 abridged)*, 16 pp. Manhattan, Kansas, November, 1917.

HORSES

The feeding of draught horses (1) has been studied much less than that of other farm animals and less is known of the influence of various foods and mixtures of foods on horses than on oxen, sheep, pigs, etc. In order to have some knowledge on this subject the Kansas Agricultural Station made a series of experiments with army draught horses.

RESULTS: — The principal numerical data are given in the appended table. They show that, by replacing the oats in the ration by a mixture of maize, 3 parts of bran and 1 part of linseed oil meal, very satisfactory results are obtained although the increases in live weight were slightly less (Groups I and XV).

Two rations containing equal quantities of maize and oats but, in

(1) Experiments on the feeding of horses have been summarised in: — R 1912, Nos. 938 and 939; R 1913, Nos. 278 and 1357, R 1914, No. 118; R 1915, Nos. 4, 409 and 939; R 1916, No. 1192 (Ed.)

Principal results of experiments in the

Lot	Number of horses in lot	Average age of horses years	Number of days fed.	Average initial weight of horses lb.	Average final weight of horses lb.	Gain or loss in live weight	Daily ration		Grain daily	
							per horse		per 1000 lb. live weight	
							lb.		lb.	
I	76	9.35	140	1131.2	1147.5	+ 16.3	Oats	12	Oats	10.51
							Prairie hay	14		
II	76	8.34	140	1180.9	1151.6	- 29.3	Maize	12	Maize	10.27
							Prairie hay	14		
III	74	10.44	140	1185.0	1172.1	- 12.9	Oats	8	Oats	6.78
							Maize	4	Maize	3.39
							Prairie hay	14		
IV	76	11.00	140	1159.3	1151.6	- 7.7	Oats	8	Oats	6.90
							Maize	4	Maize	3.45
							Timothy hay	14		
V	69	11.00	110	1196.8	1183.5	- 13.3	Oats	8	Oats	3.36
							Maize	4	Maize	6.72
							Prairie hay	14		
VI	73	11.30	110	1177.7	1169.4	- 8.3	Oats	4	Oats	3.41
							Maize	6	Maize	5.11
							Alfalfa meal	4	Alfalfa meal	3.41
							Prairie hay	12		
VII	79	11.00	110	1153.0	1156.0	+ 3.0	Oats	4	Oats	3.44
							Maize	6	Maize	5.16
							Alfalfa meal	4	Alfalfa meal	3.44
							Timothy hay	12		
VIII	75	11.86	110	1170.5	1163.8	- 6.7	Oats	4	Oats	3.39
							Maize	6	Maize	5.10
							Bran	4	Bran	3.39
							Prairie hay	12		
IX	76	10.40	110	1167.4	1173.5	+ 6.1	Oats	4	Oats	3.39
							Maize	6	Maize	5.09
							Bran	4	Bran	3.39
							Timothy hay	12		
X	77	10.00	110	1170.0	1167.5	- 2.5	Oats	4	Oats	3.41
							Maize	6	Maize	5.11
							Linseed meal	1	Linseed meal	0.85
							Prairie hay	12		
XI	18	14.00	140	1181.6	1163.3	- 18.3	Oats	12	Oats	10.26
							Prairie hay	14		
XI A	3	9.00	140	1100.0	1108.3	+ 8.3	Barley	12	Barley	10.86
							Prairie hay	14		
XII	17	12.00	140	1163.2	1188.8	+ 25.6	Maize	8	Maize	6.80
							Oats	2	Oats	1.70
							Alfalfa hay	10		
XV	22	12.00	140	1150.3	1163.2	+ 3.9	Maize	6	Maize	5.16
							Bran	3	Bran	2.58
							Linseed meal	1	Linseed meal	0.86
							Prairie hay	14		
XVIII	18	12.50	75	1107.7	1180.0	- 17.7	Oats	10	Oats	8.32
							Brown sugar	5	Brown sugar	0.42
							Prairie hay	14		

feeding of draft horses in Kansas

	Hay daily per 1000 lb live weight	Digestible nutrients per day per 1000 lb live weight			Total digestible nutrients per day per 1000 lb live weight lb	Nutritive ratio	Cost of grain per day per 1000 lb live weight ¢	Cost of hay per day per 1000 lb live weight ¢	Total cost of food per day per 1000 lb live weight ¢
		Protein lb	Carbo- hydrates lb	Fat lb					
Prairie hay	12 25	1 492	10 742	0 595	12 629	1 79	0 126	0 076	0 202
Prairie hay.	11 98	1 100	11 900	0 633	13 702	1 11 5	0 100	0 075	0 175
Prairie hay	11 86	1 345	10 76	0 5,3	12 700	1 89	0 114	0 074	0 188
Timothy hay	12 08	1 34	10 897	0 567	12 809	1 90	0 117	0 075	0 192
Prairie hay	11 75	1 236	11 219	0 604	13 059	1 10 1	0 106	0 073	0 180
Prairie hay	10 22	1 448	10 846	0 533	12 827	1 93	0 115	0 064	0 179
Timothy hay	10 34	1 441	10 406	0 517	12 664	1 83	0 116	0 065	0 180
Prairie hay	10 1	1 467	10 877	0 594	12 938	1 83	0 124	0 063	0 188
Prairie hay	10 17	1 449	10 847	0 565	12 861	1 83	0 124	0 063	0 198
Prairie hay	10 23	1 327	9,789	0 571	11 687	1 83	0 016	0 064	0 170
Prairie hay	11 98	1 457	10 300	0 581	12 338	1 79	0 123	0 075	0 198
Prairie hay	12 68	1 292	12 531	0 376	14 199	1 10 3	0 147	0 079	0 226
Alfalfa hay	8 50	1 655	8 721	0 408	10 784	1 58	0 087	0 042	0 129
Prairie hay	12 05	1 330	9 975	0 538	11 843	1 84	0 092	0 075	0 167
Prairie hay	11 65	1 239	9 455	0 502	11 106	1 85	0 121	0 073	0 194

one case, 4 lbs. of bran, and, in the other, 1 lb. of linseed meal, gave almost identical results, except than the second made the horse's coats somewhat better (Groups IX and X).

In equal weights oats and barley proved similar as foodstuffs, but preference should be given to oats on account of their better effect on the general condition of the horses (Groups XI and XII A).

In small quantities sugar is a good addition and suits the horses but substituting it for oats at the rate of 5 lbs. of brown sugar for 2 lbs. of oats proved unsatisfactory (Groups I and XVIII). Horses receiving this amount of sugar perspire more easily and more abundantly than others, but their appetites are very good and their coats shiny.

A comparison between alfalfa meal and bran (Groups VI and VIII; VII and XI) showed that, in equal quantities, the food value of these two substances is nearly equal. Alfalfa meal reduces the daily food cost by about \$0.0093 per 1000 lb. of live weight, but is inferior to bran because it contains dust and irritates the mucous membranes. It may also be adulterated or prepared with more or less deteriorated alfalfa.

A mixture of alfalfa, maize and oats proved less expensive than a ration of oats and prairie hay and gave a greater increase in live weight (Groups XI and XII).

Replacing 2 lbs. of maize and 2 lbs. of prairie hay by 4 lbs. of alfalfa meal did not reduce the cost of feeding (Groups V and VI).

One pound of alfalfa is estimated to have the same food value as 1 1/2 to 2 lbs. of timothy hay or prairie hay, its use in the ration reduced the amount of roughage and concentrated foodstuffs consumed by 30 % for the first and 16 % for the second. The cost of feeding was less and the gains in live weight greater.

Timothy hay proved slightly superior to prairie hay.

In calculating the cost of the various rations the following prices have been taken: Barley 65 cents a bushel, maize 55 cents a bushel, oats 38 1/2 cents a bushel, bran \$20 a ton, alfalfa meal \$14 a ton, linseed meal \$35.50 a ton, brown sugar \$5 a cwt, prairie hay \$12.50 a ton, timothy hay \$12.50 a ton, alfalfa hay \$10 a ton.

335 - **Feeding Pure bred Draft Fillies, Investigations, in Illinois, U. S. A.** - EDMONDS, J. L., in the *University of Illinois, Agricultural Experiment Station Bulletin* No 192, pp. 1-248 + 18 fig. Urbana, Ill., December 1, 1916.

Ten pure-bred Percheron fillies were subjected to feeding tests during two years in order to ascertain the efficacy of alfalfa hay, maize and oats. The experiment was begun on December 8, 1914, and ended when the foals were put back on pasture on May 8, 1916 and thus included three winters and one summer. Equal parts of maize and oats were fed as concentrated foodstuff and, as roughage, exclusively alfalfa hay. The first winter the oats and maize were ground, afterwards they were fed whole. The pasture consisted mainly of *Poa pratensis*, with a few other grasses. Except during the first 28 days, during which the foals were given grain and hay *ad lib.*, the grain was given in limited quantities and hay at the rate of 1 lb. or more per 100 lb. of live weight.

The results show that abundant leguminous hay should form the basis of rations for young growing horses, and that the amount of grain necessary to produce good growth must be given. As the horses grow older the ratio of grain to hay may be safely decreased, indeed, good gains in live weight are thus obtained. In this experiment $\frac{1}{2}$ lb. of grain per 100 lb. of live weight daily produced good growth, except during a short period of scant pasture.

The daily average gain in live weight per head throughout the experimental period of 518 days was 1.32 lb., the total gain per head being $1\frac{1}{3}$ lb. and the average growth in height 8 inches. The average total quantity of food eaten per head during the whole experiment was 44.35 bushels of maize, 19.36 bushels of oats, 2.58 tons of alfalfa hay, and $\frac{4}{5}$ acre of pasture.

The average quantity of food necessary to produce 1 lb. gain in live weight was:—during the first winter, 5.67 lb. of grain and 4.27 lb. of alfalfa hay; during the second winter, 9.23 lb. of grain and 13 lb. of hay. The average weight of the foals was 1112 lb. at 1 year and 1518 lb. at 2 years. Calculating the price of the foodstuffs at \$14 per ton for alfalfa hay, 65 cents per bushel for maize, 40 cents per bushel for oats, and \$1.50 for pasture, the cost per lb. of live weight gained was 9.83 cents the first winter, 18.24 cents the summer, and 20.22 cents the second winter. The total cost of foodstuffs per head was, on an average, \$67.34 per year, and \$105.50 for 17 months.

336 — **Five Years Calf Feeding Work in Alabama and Mississippi.** — WARD, W. F. and JERDAN, S. S., in the U. S. Department of Agriculture, Bulletin No. 631, 53 pp. Washington April 19, 1915.

CATTLE

I. — **WINTER FATTENING OF CALVES ON COTTONSEED MEAL, COTTONSEED HULLS, CORN AND COB MEAL, AND ALFALFA HAY IN ALABAMA (1911-1912).** The objects of the experiment were:— 1) to determine the most profitable methods of breeding and fattening calves for sale at 1 year; 2) to compare the foodstuffs and mixtures of foodstuffs suitable for the winter fattening of calves in the south of the United States. The experiment, made at Sumterville, lasted 107 days (from November 17, 1911 to March 3, 1912). Forty-seven picked calves, between 6 and 8 months of age, and weighing, on an average, 376 lb. at the beginning, were divided into three lots, kept separately in paddocks (with covered shelters) and fed as follows:—

Lot 1 (16 calves):— Cottonseed meal, cottonseed hulls and mixed hay (alfalfa and Johnson grass).

Lot 2 (15 calves):— A mixture of $\frac{2}{3}$ cottonseed meal and $\frac{1}{3}$ corn and cob meal, cottonseed hulls and mixed hay.

Lot 3 (16 calves):— A mixture of $\frac{1}{3}$ cottonseed meal and $\frac{2}{3}$ corn and cob meal, cottonseed hulls and mixed hay.

For the whole experiment the average daily gain in live weight per head was 1.94 lb. in Lot 1, 1.75 lb. in Lot 2 and 1.59 lb. in Lot 3. The cost of the food necessary to produce 100 lb. gain in live weight (according to the prices of food at Sumterville in 1911) was \$5.14, \$5.72, and \$7.43 for each lot respectively.

Calculating the initial cost per lb. of the calves as 4 cents and their sale price on the farm as 5 ½ cents (deducting 3 % of the live weight at the time of selling to compensate for the loss of weight during transport to the buyer), the average profit per calf was \$5.40, \$4.30 and \$4.07 in each lot respectively.

II. — FATTENING CALVES ON COTTONSEED CAKE, COTTONSEED HUSKS, GROUND MAIZE AND MAIZE SILAGE, IN ALABAMA (1912-1913) — The objects of the experiment were the same as that of the first. It was also made at Sumterville, using 48 calves of the same breed and age as the first, and kept in the same paddocks. The experiment was begun on November 29, 1912. The 48 calves, which then weighed on an average 371 lb., were divided into three lots of 16 and fed as follows till March 3, 1913: —

Lot 1: — Cottonseed meal and cottonseed hulls.

Lot 2: — A mixture of 2/3 cottonseed meal and 1/3 chopped maize, cottonseed hulls, and maize silage.

Lot 3: — Cottonseed meal cottonseed hulls and maize silage.

As, on March 3, 1913 all the supply of maize silage was exhausted, it was no longer possible to keep the three groups and all the calves were kept together. They were then fed till April 29 (58 days) a ration consisting of cottonseed meal, chopped maize, cottonseed hulls, and mixed hay.

During the first period, from November 29 to March 3 (93 days), during which Lots 2 and 3 received maize silage, the average daily gain in live weight per head was 1.49 lb., 1.23 lb. and 1.40 lb. for each lot respectively. The cost of food per 100 lb. of gain was \$5.59, \$6.09 and \$5.13 respectively. During the second period, from March 3 to April 29 (58 days), the calves gained an average of 1.09 lb. daily per head and the cost of 100 lb. of gain was \$11.31.

III. FATTENING CALVES ON COTTONSEED MEAL, MAIZE, COTTONSEED HULLS, MAIZE SILAGE, AND ALFALFA HAY, IN MISSISSIPPI (1914-1915). — In 1914 the experiments on the feeding of stock made by the Department of Agriculture in collaboration with the Alabama Agricultural Station (from 1904 to 1913) were transferred to the tick-free district of Mississippi-Canton, in the brown loam section, and Abbott, in the black prairie section. These districts are admirably suited to stock breeding because of their soil, rich in lime, which yields abundant clover, alfalfa, and other fodder plants, and the conditions of which are similar to those of western Alabama where the first experiments were made.

The experiment described, made at Abbott, aimed at obtaining new data on the use of cottonseed meal alone or mixed with maize to fatten calves for market, so as to complete the conclusions drawn in Alabama. The 40 calves chosen were given a preliminary period (from October 25 to November 13, 1914) to get used to the conditions of the experiment. On November 14 they were divided into three groups and placed in a well ventilated byre. Here all the lots were given maize silage *ad lib.*, and cottonseed hulls and alfalfa hay in varying quantities during each of the five periods of 28 days into which the experiment was divided (it finished on April 5, 1915). In addition Lot I (14 calves) received cottonseed meal,

Lot 2 (12 calves) a mixture of $\frac{2}{3}$ of cottonseed meal and $\frac{1}{3}$ of corn and cob meal, and Lot 3 (14 calves) a mixture of these two foods in the inverse ratio ($\frac{1}{3} : \frac{2}{3}$).

Throughout the experiment (143 days) the average daily gain per head was 1.71 lb., 1.87 lb., and 1.59 lb. respectively for each lot. According to the price of the foodstuffs at Abbott in 1914, the cost of 100 lb. gain in live weight was \$6.34, \$6.34; and \$7.40, in each lot respectively.

IV. — FATTENING CALVES ON COTTONSEED MEAL, MAIZE, ALFALFA HAY, AND MAIZE SILAGE IN MISSISSIPPI (1915-1916). — The experiment was carried out at Abbott and aimed at feeding the calves for a longer period than in the preceding cases and giving a larger grain ration so as to obtain better finish for the market. During the winter 1915-1916 three lots of calves (aged 7 to 8 months and just weaned at the beginning of the experiment) were fed during 156 days in a large ventilated byre divided into stalls. They all received maize silage *ad lib.*, and 4 lb. of alfalfa hay per head daily. In addition, Lot 1 received per head daily 5 lb. of cottonseed meal, Lot 2, 2 lb. of cottonseed meal and 8 lb. of maize, and Lot 3, 12 lb. of maize.

During the 156 days of the experiment the average daily gain per head was 1.74 lb., 1.7 lb. and 1.8 lb., in each group respectively. The calves of Lot 1 grew in size, but did not fatten as rapidly as those of Lots 2 and 3. At the beginning of the experiment the calves were valued at 5 cents per lb. of live weight, at the end they were sold at St. Louis, Lot 1 for \$8.10 per 100 lb., Lot 2 for \$8.5 and Lot 3 for \$8.66.

The calves were kept in concrete floored stalls without litter. It was, thus, easy to collect and weigh the solid excreta (a large part of the liquid excreta was lost). The average daily weight of the excreta during the 156 days of the experiment was 29.2 lb., 26.2, lb., and 21.3 lb. for Lots 1, 2 and 3 respectively.

V. — MARKET FATTENING OF LATE-BORN CALVES IN MISSISSIPPI (1916). — The experiment, made at Abbott, aimed at determining the best method of fattening for market calves born too late (end of spring or even summer) to be fattened profitably during the following winter. A certain number of calves of this class were left with their mothers during the winter 1915-1916, weaned in the spring of 1916, and put to pasture on May 5 so as to be ready for sale during the autumn or winter. They were divided into two lots which, in addition to pasture, received in one case, cottonseed meal, and, in the other, a mixture of $\frac{1}{3}$ of cottonseed meal and $\frac{2}{3}$ maize. As the exceptional drought of the summer had greatly reduced the grass of the pastures, it was found necessary to increase the concentrated food ration of each lot; in Lot 1 it was increased at first about three times, and, finally, four times; in Lot 2 it was first doubled and then increased six times. The calves were thus fed till October 30.

During the period from May 5 to October 30 (179 days), the average daily gain was 1.41 lb. in Lot 1 and 1.63 lb. in Lot 2. From October 30 the calves were finished in the byre. The two lots, kept in separate stalls, received the same concentrated food ration as before and, in addition, maize

silage as roughage. They were thus fed till the experiment ended on January 5, 1917.

During the 67 days of this finishing period the average daily gain per head was 1.40 lb for Lot 1, and 1.52 lb. for Lot 2. The calves fed maize were fatter than the others and gave a higher meat yield (54.7 % as compared with 52.8 %).

In estimating the profit made on the sale of the calves the concentrated foodstuffs were calculated at their 1916 price at Abbot, maize silage at \$3 per ton, the pasture of one calf during 28 days at 50 cents, the calves at \$5 per 100 lb. at the beginning of the experiment and \$8.05 (Lot 1) and \$8.48 (Lot 2) per 100 lb. yielded at the St. Louis slaughter house. The profit found was \$10 per calf in Lot 1, and \$9.64 per calf in Lot 2.

337 - The Economical Winter Feeding of Beef Cows in the Corn Belt of the United States. — CORRON, H. S., and THOMPSON, E. H., in the *U. S. Department of Agriculture, Bulletin No. 615*, 16 pp. + 1 Fig. Washington, November 15, 1917.

An investigation made by the U. S. Department of Agriculture in the corn belt during 3 years has shown that when fattened calves are sold there at a loss it is usually on account of the excessive maintenance cost of the breeding cows. This cost must, therefore, be reduced by more economical feeding, especially in winter and the authors show the necessity of making more use of the by-products of the farm (corn stover, straw, etc.) and of paying great attention to the composition of the ration.

The maintenance cost of breeding cows and the cost of producing fattening calves (usually sold to be fattened) were ascertained by enquiries on 1 000 farms. On 478 farms producing calves to be fattened as baby beef, the cost of producing a calf, at the time of weaning, varied from \$25 to \$50 and was, on an average, \$37.

The breeding cows of these 478 farms were divided into four groups, according to the number of nutritive units contained in their ration (see Table I).

TABLE I. — *Effect of various amounts of winter food on the economical production of calves.*

Lots	Number of food units supplied to each cow (during 165 days)	Average number of food units fed	Cost of winter food per cow \$	Cost of keeping a cow one year \$	Cost of calf at weaning \$
I	less than 1750	1 550	10.70	29.00	30.00
II	1750 2250	2 000	13.50	33.50	35.03
III	2250 2750	2 350	18.50	37.20	41.00
IV	more than 2750	3 000	21.00	39.00	43.00
	Total of the 478 farms	2 280	15.50	34.50	37.00

These results show that in Lot III and IV large quantities of food were wasted. At weaning, 800 calves from the cows of Lot I were sold at an

average profit of \$ 4.60 per head, whereas the 700 calves of Lot IV were sold at an average loss of \$ 8.90 per head.

The results obtained by the feeding methods adopted on the 478 farms are summarised in Table II.

TABLE II. — *Average percentual composition of the rations with respect to the variations in the percentage of cheap roughage used. Influence of this composition on the maintenance cost of a cow and the cost of production of a calf.*

Number of farm	Relative quantity of cheap roughage	Average percentual composition of rations				Total number of food units	Daily cost of feed per cow	Cost of winter feed per cow	Cost of cow at weaning
		Cheap roughage	Hay	Corn fodder and maize silage	Grain				
14	0	0 %	54 %	35 %	11 %	1 950	11.0	18.00	39.00
229	1-40 %	24	47	23	6	2 250	10.7	17.70	39.00
207	40-80 %	58	28	10	4	2 350	8.2	14.80	34.00
28	more than 80 %	89	6	2	3	2 150	5.5	9.00	30.00

This table shows that the cost of winter feeding decreases as the proportion of roughage in the ration is increased, when this proportion exceeds 80 % the cost of feeding is half that when 10 % roughage is fed. The use of concentrated foods (grain), though sometimes advisable (breeding pure-bred stock, or for show purposes) may often be more or less completely suppressed. On 151 of the farms studied the breeding cows were fed maize for at least part of the winter, raising the average cost of winter feeding to \$ 17.10 per head, as compared with \$ 14.80 for cows receiving no maize. In spite of its food value, maize silage cost relatively more than a large proportion of roughage.

335 Researches on the Use of Mustard Seed Cake and Meal as Food for Dairy Cattle, in Denmark. *Mælkeavl* 1917-18, No. 13 p. 30. Ohlsson, O. (1918).

Feeding experiments made at the Royal Research Laboratories at Copenhagen by Messrs. LIEGERARD and RASMUSSEN, during the winter of 1917-1918.

In spite of the fairly pronounced bitter flavour of mustard seed cake and meal, the test animals in general did not refuse them. The cows of Group I received, per head per day, 19 kg. of cotton cake, 40 kg. of beets, 25 kg. of hay and 2.5 kg. of straw. Those of Groups II and III received the same ration as those of Group I, save that half the cotton cake was replaced by 1.24 kg. of mustard seed cake and 1.24 kg. of mustard seed meal respectively or, in other terms, 1 part of cotton cake was replaced by 1.3 parts of one or other of the respective foods.

RESULTS. — For milk production, 1.3 parts of mustard seed cake or meal had the same food value in the ration as 1 part of cotton cake.

Each of the two foods tested tended to render the butter more soft and might, in this respect, be compared to rape or sunflower cake.

Mustard seed cake or meal should be introduced into the ration by degrees, up to a maximum of 1.25 kg. per head per day for ordinary cows and 1.50 kg. for very good milkers.

349 - Stock Rearing and the Meat Trade in Brazil. — *O Criador Paulista*, Year XIII, No. 12, pp. 373-377 + 1 Fig. São Paulo, December, 1918.

Data taken from a paper presented by Sig. SIMÕES LOPES, deputy for the state of Rio Grande do Sul, to the President of the Brazilian Republic.

During the 5 year period 1913-1917, Brazil, once a country importing meat, became an exporter, as is shown by the following figures :—

	Importations, in metric tons		Exportations, in metric tons	
	1913	1917	1913	1917
Frozen meat	0	0	0	66 451 *
Dried meat	14 371	1 570	21	1 156
Tinned meat	353	23	223	2 560
Totals	14 724	1 593	244	73 167

* In the first 7 months of 1918, 40 667 metric tons (J. S. TAVARES, *Bioteria, Serie de Vulgarização Científica*, Vol. XVII, Pt. 1, pp. 17-22, Braga, January 1919).

According to the "Anuario estatístico" (Statistical Annual) for 1912 issued by the Ministry of Agriculture, there were 30 705 400 head of cattle in Brazil in that year. Allowing a utilisable yearly production of 20% (according to M. COSNIER, this production was 30 % in France before the war) and an annual increase of the herds of 1.5 % (which is a reasonable figure, for the official figures for the last few years put it at 3.3 % in the state of Rio Grande, and the herds of the state of São Paulo, Paraná, Matto Grosso and Goyaz, were said to increase by 7 % at the last Zootechnical Congress at São Paulo), then taking the round figure of 30 million head for 1912, we get, for 1917, a population of 32 313 519 adult cattle, while another 6 463 703 head will also be available.

During the 5-year period 1913-1917, Brazil exported :— 103 467 000 kg. of frozen meat (which, at 250 kg. of meat per animal, represents 413 868 head of cattle) ; 11 500 000 kg. of dried meat (which, at 75 kg. per animal, represents 153 333 head) ; 4 002 000 kg. of tinned meat (which, at 80 kg. per animal, represents 50 000 head) ; that is, a production of 617 000 cattle in round figures. In the same period the internal consumption increased by 186 000 000 kg. (increase of population from 24 'o 27 millions ; average yearly consumption per head of 62 kg.), representing, in round figures, 744 000 cattle ; thus the exportation + the increase in internal consumption represent 1 361 000 head which can be slaughtered without making inroads on the main body of live stock.

It can be foreseen that with the progress of the frozen meat industry, that of dried meat will finally disappear, as it did in the Argentine. However, it is still very important, as is shown by the fact that, in 1917, there was a national production of 58 500 metric tons (46 000 in the state of Rio Grande), with an importation of 1 600 metric tons and an exportation of 4 200 metric tons, while the internal consumption was 55 900 metric tons.

340 - **Cattle Raising in the Dominican Republic.** — MC LEAN, A., in *Commerce Reports*, No. 147, p. 1151. Washington, D. C., 1918.

Cattle raising is among the most promising industries in the Dominican Republic. There are said to be 3 000 000 acres of land suitable for grazing in the Republic. These lands are well watered by numerous streams and rivers, on which guinea and other grasses grow luxuriantly. With one or two exceptions there are no large ranches, although nearly every farmer has a few head of cattle. Good grazing lands are held here at \$30 and more per acre. It is not known how many cattle there are, but the supply is ample for local requirements, with at times a small surplus for export, mostly to Porto Rico and Haiti.

The principal breeds of cattle are Holstein and Porto Ricans, crossed with the native cattle, the average weights of which at 5 years are 400 to 500 lb. The cattle could no doubt be greatly improved by the introduction of better breeds and scientific management.

While some minor diseases exist among the cattle, they are on the whole healthy and comparatively free from pests which are so common in other tropical countries. The cattle are left in the open all the year round, and no barns are provided for their protection.

Cattle are usually slaughtered in the municipal slaughterhouses, and the meat placed on sale at the markets the day following. Most of the by-products are wasted. The hides are arsenic cured, and the greater part are exported. There is, however, an increasing amount of hides tanned in this country and used locally in the manufacture of shoes, saddles, and harness.

341 **Comparison Between the "Gujerati" and "Delhi" Breeds of Hindoo Buffaloes for Milk Production.** — SMITH, W., in the *Journal of Dairies and Dairy Farming*, Vol. VI, Pt. 1, pp. 26 + 2 figs. Calcutta, October, 1918.

Up till recent years all the milk produced near Bombay and consumed in that town was supplied by the Delhi (Nurrah) and Jaffrabadi breeds of buffaloes. The last few years the small "Gujerati" breed, more commonly known in Bombay as "Surti", was introduced into this district, where it is doing well because it is quiet, cheaper to buy and feed and a better milk producer. On August 1, 1916, a herd of 48 Gujerati buffalo cows bought in the Anand del Guggerat district was formed on the Military Dairy Farm at Kirkee. During the first lactation period these buffaloes gave an average of 2 756 lb. of milk per head. On September 20 a herd of 48 Murrah buffalo cows bought in the Rohtak district was formed. During the first lactation period they gave an average of 2 504 lb. per head.

The average price of the first lot was 126 *rupees* each, and of the second

239 rupees. The rations fed contained equal quantities of grain, but the Gujerati buffaloes consumed 15 lb of hay and the Murrah buffaloes 20 lb. The average live weight of a Gujerati cow is 880 lb. and that of a Murrah cow 1320 lb. The composition of the milk is about the same for both breeds (8.4 % of fat and 10.82 % of fat-free matter in the Gujerati breed, and 7.5 % and 10.14 % respectively for the Murrah).

The Gujerati breed has been introduced into the furthest districts of India and done well there. It may be said to supply the best Hindoo buffalo milk. Its one defect is that it yields little meat; it is for this reason it is cheap as all animals are finally slaughtered. Gujerati buffaloes are greyer than the Murrah ones, which are usually a brilliant black; light grey marks on the breast are considered a sign of a good milking family.

342 — **Sheep Breeding and Feeding (v); Investigations in Texas, U. S. A.** — JONES, J. M., in the *Texas Agricultural Experiment Station Bulletin* No. 205, 44 pp. Austin, Texas, January, 1917.

The experiments described aimed at determining which of the more common breeds of rams when crossed with fine-woolled ewes give the most satisfactory and strongest lambs when bred and fattened under Texas conditions. For the experiments were used 118 good Rambouillet ewes of the same type and bred in the same manner, and kept at grass. They were divided into 6 lots served by: 1) Rambouillet, 2) Shropshire, 3) Hampshire, 4) Southdown, 5) Lincoln, 6) half bred Caracul Lincoln rams respectively. There were 120 lambs, all healthy and strong from birth. The highest average weight was obtained with the cross Hampshire × Rambouillet, the Lincoln × Rambouillet cross gave the greatest total gain and fattened most rapidly. The cost of feeding the 120 lambs per 100 lb. of gain throughout the experiment was, from October 13-January 5, \$ 3.22, and from January 6-17, \$ 5.03.

The five best lambs were chosen from each group and fattened from January 6 to March 8 to be shown at the National Feeders' and Breeders' Show. During this period the cost of feeding per 100 lb gain was \$ 6.32. At the show they were classed in the following decreasing order: Lan-

(1) At the Iowa Agricultural Station (*Iowa Station Bulletin* No. 25) CURTIS and WILSON made a series of feeding tests with lambs which aimed at comparing the value of the meat and wool and their cost of production of some of the principal breeds. They used Southdown, Shropshire, Oxford, Suffolk, Lincoln, Cotswold, Dorset, Merino, and Shropshire × Merino cross sheep. The investigation lasted a year, the first 81 being 60 days and the second 100. The average cost per lb gain in live weight for the two tests was: Cotswold 56.5 cents, Lincoln 25.8 cents, Rambouillet (1 to 1 only) 29.1 cents, Dorset 29.3 cents, Southdown 30.0 cents, Shropshire 30.1 cents, Oxford 30.5 cents, Suffolk 31.6.

At the South Dakota Agricultural Station (*South Dakota Bulletin* No. 127) WILSON made an experiment similar to that of the author taking the averages of the result of 6 tests made with a total of 341 lambs. He found that the quantity (in lbs) of concentrated food required to produce 1 lb gain in live weight was: Cotswold 5.21, Oxford 5.43, Rambouillet 5.63, Southdown 5.64, Shropshire 5.78, Hampshire 5.87. (*Author*) — See also *R. Aug.*, 1913, No. 961. (*Id.*)

coln × Rambouillet Hampshire × Rambouillet, Southdown × Rambouillet, Rambouillet-Caracul × Rambouillet, Shropshire × Rambouillet. Throughout the experiment, from October to March, these lambs consumed 8.06 lb. of dry fodder per lb. of gain.

During all the tests the animals were given salt. The salt troughs were slightly modified so as to apply pine tar to the animals nostrils with the object of keeping away gad-flies; this device seems to have been successful. The troughs were 4 inches deep, 6 inches wide, and 4 feet long; along the whole length was a board 3 1/2 inches wide fixed at 2 1/2 inches from the bottom. A piece of sheep's skin was nailed on to this shelf, wool uppermost. Each evening, shortly before each lot of lambs was taken back to the fold, this skin was soaked with pine tar.

343 - **Lessons in Pig Breeding in the Elementary Rural Schools of the United States.** — MILLER, E. A., in the *U. S. Department of Agriculture, Bulletin No 646*, 15 pp. + 15 Figs. Washington, April 8, 1918

PIGS

The author first deals with the importance of pig breeding in the United States (according to the census of January 1, 1917, the stocks are: pigs 67,453,000, sheep 48,183,000, milk cows 22,678,000, other cattle 40,819,000, horses and mules 25,705,000) and the educational value (in developing observation, etc.) to be derived from lessons in pig breeding, including practical exercises, observations in the principal breeding centres, the use of pig performance record cards, sketches of sties, etc., as well as the application of the principles learnt at school to the home sties. He then describes this instruction, in 9 concise lessons, together with the exercises set and publications to be consulted (the *Farmers' Bulletins* of the Department of Agriculture). The questions treated are: - 1) types and breeds; 2) sties; 3) judging of the pigs; 4) fattening pigs for pork; 5) choice of breeding animals; 6) care of sows and pigs; 7) food; 8) hygiene and diseases.

344 - **Swine Feeding in Wyoming, U. S. A.** — FAVHILL, A. D. in the *University of Wyoming Agricultural Experiment Station, Bulletin No 111*, 8 pp. Laramie, Wyoming, July 1917

Fifteen pigs, of an average weight of 87 lb., were divided into three lots and fed during 70 days as follows: - Lot 1, ground barley; Lot 2, ground barley + meat meal in the ratio of 9:1; Lot 3, ground rye. The cost of the foods and of the pigs was: grain \$ 25 per ton, meat meal \$ 55 per ton, pigs, bought \$ 7.00, sold \$ 9.40 per 100 lb.

Lot 1 made a daily average gain of 1.46 lb. with a consumption of 413 lb. of food per 100 lb. gain, at a cost of \$ 5.16 per 100 lb. gain. Lot 2 gained on an average 1.74 lb. a day, with a consumption of 370 lb. of food per 100 lb. of gain at a cost of \$ 5.18 per 100 lb. gain. Lot 3 made an average gain of 1.53 lb. daily, with a consumption of 384 lb. of food per 100 lb. of gain costing \$ 4.35 per 100 lb. gained.

During the first six weeks the grain was mixed with water and given to the pigs immediately after; during the last four weeks it was soaked between the meals. Soaking increased the amount of grain consumed and

the grains in weight, but did not modify appreciably the weight of food consumed to produce the unit of gain.

345 - The Self Feeder for Hogs, in the United States. — ASHBROOK, F. G. and GONGWILK, R. E., in the *U. S. Department of Agriculture, Farmers' Bulletin*, No. 906, 12 pp. + 8 Figs. Washington, December, 1917

In a test made at the Experiment Farm of Beltsville, Maryland, two lots of 9 pigs were fed for 70 days, one from an ordinary trough, the other from a self feeder, on maize meal, middlings and tankage. Lot 1 made a daily gain of 1.04 lb. per head, consuming 410.1 lb. of food per 100 lb. of gain. Lot 2 made a daily gain of 1.62 lb. per head with a consumption of 406.4 lb. per 100 lb. gained.

In another test lasting 28 days, 5 pigs left to graze in a rye field and receiving in addition a mixture of maize meal and tankage (38 : 1) in a self feeder, made a daily average gain of 1.61 lb. per head, consuming, in addition to the pasture, 362.8 lb. of food per 100 lb. of gain. Five other pigs put to graze in a rye field and given in addition a mixture of maize and tankage (10.3 : 1) in a self-feeder, gained 1.53 lb. per head daily, consuming, in addition to the pasture, 331.7 lb. of food per 100 lb. gained. A third lot of 5 pigs allowed to graze in a rye field and given at the same time a mixture of maize meal, middlings and tankage (5 : 4 : 1) (hand fed) made a daily gain of 1.48 lb. per head with a consumption of 360 lb. of food per lb. gained in addition to the pasture.

The results obtained in the various agricultural stations of the United States with about 600 pigs, show that, on a general average, pigs fed in ordinary troughs consumed 5.47 lb. of food daily per head and gained 1.23 lb. per head per day with a consumption of 445 lb. of food per 100 lb. of gain, whereas when pigs were fed from a self-feeder the corresponding figures were 8 lb., 19 lb. and 417 lb. When pigs have a well-balanced ration distributed so that it neither spoils nor wastes, they eat more and make more rapid and economical gains than when fed in ordinary troughs.

Details and illustrations are given of the construction of practical and economical self-feeders.

346 - Breeds of Swine in the U. S. A. — ASHBROOK, G. F., in *U. S. Department of Agriculture, Farmers' Bulletin* No. 765, 16 pp. + 14 Figs. Washington, D. C. March, 1917

The writer gives information concerning the various breeds of swine, their origin, general appearance, development and adaptability.

There are two distinct types of swine, the lard and the bacon types. Swine of the lard type far outnumber those of the bacon type in the United States. The lard type is preferred by the people of that country, consequently the majority of feeders produce the rapid fattening, heavily fleshed lard type.

The bacon type is not raised extensively in the United States. The production of choice bacon is more general in those countries where the feed of the hog is more varied and where maize is not relied upon as the principal grain for hogs.

The principal breeds of the lard type are Poland-China, Berkshire, Ches-

ter White, Duroc-Jersey and Hampshire. The principal breeds of the bacon type are the Tamworth and the Large Yorkshire.

There is no best breed of swine. Some breeds are superior to others in certain respects, and one breed may be better adapted than another to certain local conditions. This is a matter which the farmer will have to decide for himself.

347 - Luteal Cells and Hen Feathering. — BORING, A. M. and MORGAN, T. H., in *The Journal of General Physiology*, Vol. 1, No. 1, pp. 127-131 + 4 Figs. Baltimore, September, 1917

Nearly all fowls have sexual dimorphism of the plumage which often affects its colour. In the Sebright breed, however, the plumage of the cock is almost identical with that of the hen. In other breeds, such as the Campine and Hamling ones, adult males are found sometimes having the characteristic plumage of the cock and sometimes that of the hen.

BORING and PEARL have shown that the hen's ovary contains a group of cells which, after laying, collect together in the follicle, producing there a yellow pigment similar to the luteal pigment of the *corpus luteum* of mammals and named by them "luteal cells". They have also shown that the testes of the male do not contain these cells. GOODALE has shown that hens and ducks subjected to ovariectomy acquire the plumage characteristic of the male, but this operation is not sufficient to determine the part eventually played by the luteal cells in the formation of plumage. If, in the testes of the Sebright cock, were found an element which does not exist in cocks of normal breeds and is, at the same time, peculiar to the female organism, the theory that these elements form the factor of hen-feathering in the Sebright cock and hen would appear very probable. An histological examination of the testis of a Sebright cock showed the presence of a group of luteal cells apparently identical with those of the hen. It seems to be the secretion from these cells which suppresses cock feathering in the Sebright cock. In support of this conclusion one of the authors has recently shown that castrating the Sebright male determines the appearance of the normal cock feathering. The result of this castration is, then, identical with that of ovariectomy reported by GOODALE, and is caused by the suppression of the luteal cells. It should be noted that castration of the males of normal breeds of fowls determines no modification in the character of the plumage.

348 - Experiments on Feeding Poultry with Dried yeast. — KORNIC, in the *Western Brewer*, 1918, p. 135, quoted in *Bread and Malt*, Year VIII, No. 18, p. 295 Nancy, December, 1918

In these experiments, each fowl received: three times a day, one ounce of a mixture of 0.9 kg. of dried yeast + 3.6 kg. of maize + 3.6 kg. of wheat + 4 kg. of oats *ad lib.*, a dry mixture of equal weights of maize meal, crushed oats, wheat bran and middling; once a day, one ounce of grass, or green oats, or beets.

Compared with meat scraps, the dried yeast increased the egg production by 8 % with fowls kept enclosed, and by 4 % with fowls running free;

in addition the fowls gained weight and were in perfect health. Again, dried yeast was efficacious against scouring in both young and adult birds.

319 - **Turkey Raising.** — WHELAN, A. S. (Animal Husbandry Division), in *U. S. Department of Agriculture, Farmers' Bulletin* 791, 26 pp. + 16 Figs. Washington, D. C., March, 1917.

Full directions are given for raising turkeys, the points discussed being the turkey industry in the United States, profits from turkey raising, varieties, management of breeding stock, incubation, brooding, fattening for market, caponising, marketing and diseases.

For several reasons the number of turkeys in the United States is decreasing. According to the census of 1900 there were in the United States at that time 6 594 695 turkeys, while by 1910 the number had decreased to 3 688 708. Poultry dealers throughout the country state that the decrease has continued ever since the last census. The principal cause of the decrease is that as the population of the country increases farming becomes more intensive, and every year the area of range suitable for turkey raising is reduced. Furthermore, the high mortality among young poults as ordinarily cared for on the farm, the outbreaks of disease, particularly of blackhead, among the turkeys in certain sections of the country, together with serious losses resulting from the presence of predatory animals in other sections, have tended greatly to discourage the turkey industry.

The average price received by the producer for live turkeys ranges from about 12 cents a pound in Texas to 25 cents in parts of New England. During November and December 1915 the price averaged about 13 cents in Tennessee, 13 $\frac{1}{3}$ in Mississippi, 14 $\frac{1}{2}$ in Missouri, 17 in Ohio, 20 in California and 21 in New York.

Turkey raising, as ordinarily engaged in, is a side line upon the general farm. For those who are favourably situated for raising turkeys, a more profitable side line can hardly be found. Plenty of range is essential to success.

The wild turkeys originally found in North America from New England to Arizona and Florida are still found in the more unsettled sections of their former range, particularly in the mountainous parts of Texas, New Mexico and Arizona, and in the large swamps and hummocks of the Gulf States. Of the domestic varieties the more widely known is the Bronze, after which come the White Holland, the Bourbon Red, the Black, the Narragansett and the Slate.

Some of the most common rations for poults are as follows :-

1) Hard-boiled egg chopped fine and maize bread crumbs for the first week, and then whole wheat and hulled oats.

2) Stale bread, soaked in milk and squeezed dry, for the first few days and then common chick feed.

3) Clabbered milk seasoned with salt and pepper, maize-bread crumbs.

4) Equal parts "pinhead" oats, whole wheat, and cracked maize.

5) Cracked wheat.

6) Maize meal and wheat bran mixed in the proportion of 3 to 1 and baked into bread.

7) Bran or middlings $\frac{1}{2}$, cracked Egyptian corn $\frac{1}{4}$, wheat and hulled oats $\frac{1}{4}$.

In addition, skimmed milk and buttermilk are quite often fed, with excellent results. Chopped onion tops, lettuce leaves, dandelion leaves, and alfalfa make excellent green feed. Grit can be furnished in the form of coarse sand.

Very little has ever been done in the way of caponising turkeys, but when it has been tried the capons were found to be much quieter in disposition and less liable to range over a wider area than the toms, and this character should be of considerable advantage in getting them in condition for the market.

350 - Improving Crosses in Poultry. — DR. CARVALHO DELGADO, in *Chacaras e Quintais*, Vol. XVIII, No. 6, pp. 473-474 + 1 fig. São Paulo, December 15, 1918

To be successful in breeding ducks, the drake should be of another breed than that of the ducks. Thus, excellent results have been obtained with the following crosses:—

Rouen (French) + Aylesbury (English); Pekinese duck × common duck; Aylesbury × common duck (all three with fertile hybrids); Cairina (Brazilian) × Aylesbury (sterile hybrids); Rouen × Pekinese duck, etc. The first of these crosses is considered to be the best of all; the author advises that a little "Cairina" blood be added so as to get bigger hybrids. In Brazil, the cross between the domestic duck and *Anas boschas* ("marreco comum") is not uncommon, but it is sterile; in the northern states it is called "patueira" or "patury".

It might be profitable to use crossing in breeding geese. The author recommends crossing the common Brazilian goose with the Chinese or Toulouse goose. Different breeds of geese can be quite easily crossed, and crossing even occurs spontaneously when the geese live in freedom together.

351 - Fertilisation and Crossing in Bees. — BELTAUX, A., in *L'Aptellon*, Year I, XIII, No. 1, p. 3 Paris, January, 1919

The author quotes observations made by M. GLAUX in his presence:— 1) sometimes the young queens are fertilised several times before commencing laying and they are then more prolific than those fertilised only once; 2) when the young queen returns fertilised after the nuptial flight, she is immediately surrounded, when on the board, by a cluster of bees of the size of a nut and forcibly compressed; the workers surround the queen in this way so as to make the spermatheca penetrate into her genital organ; 3) the royal food-paste is composed of bee larvae mixed with the ordinary food of worker larvae.

The author states that he received through the post several boxes containing queens of the breed known as "Pennsylvania golden", which had not suffered in any way from being closed up in a small space for so long a time. The author utilised them in his hives. The workers and males of this breed are of a fine yellow colour and have retained this character

for a long time in France. The queen is very prolific, but lays too early for France; the cross with black bees is good, but the author has not found that these hybrids produce more than the Italian breed, which he prefers above all others.

VARIOUS
ANIMALS

- 352 - The "Cangamba" (*Conepatus chilensis*), a Snake Destroying Mammal of South America. IGLASIAS F., in *O Ciudad Parulista*, Year XIII, No. 12, pp. 303-305 + 4 Figs. São Paulo, December, 1918.

The author has found that the skunk *Conepatus chilensis*, a mammal distributed throughout Brazil and the other countries of South America, is a snake-eater that enjoys a complete natural immunity to the venom of these animals. In fact, it can withstand numerous bites from venomous snakes without any danger, as the author found with a *Lachesis* sp. It actively seeks for snakes (like them, it is nocturnal) and is docile, easily domesticated and clean (though it has a gland containing a foetid liquid, the author never observed any skunk domesticated by him eject this liquid, even when teased by boys, etc.). The author suggests that this valuable ally of man against snakes should be reared on a large scale.

FARM ENGINEERING.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

- 353 - Inquiry on Farm Tractors in the U. S. A. - I YERKES, A. P. and CHURCH, L. M., Tractor Experience in Illinois, a Study of the Farm Tractor under Corn Belt Conditions, in the *United States Department of Agriculture, Farmers' Bulletin*, No. 963, 29 pp. + 1 Fig. + 1 Tab. + Bibliography of 30 Publications. Washington, June, 1918 - II. In, The Gas Tractor in Britain Farming, *Ibid.*, No. 1004, 27 pp. + 3 Figs. Washington, September, 1918.

I. - Number 719 of the *Farmer's Bulletin* gave the results of an inquiry made in 1916 relating to over 200 tractor owners in the state of Illinois. Bulletin 963 sums up the data collected in the same state from 359 tractor owners during the summer of 1917 and from 284 others in the spring of 1918. These data are applicable not only to Illinois, but also to the whole of the corn belt, as the farms studied show conditions comparable to those of the corn belt farms, where maize occupies about 40 % of the cultivated area, against 60 % under oats, hay, lucerne and clover; the farms are of regular shape and have an average area of 20 acres.

A comparison between the data obtained by the 1916 inquiry and those from the 1917-1918 one shows that the number of tractor owners who consider that a tractor is a profitable investment has increased from 80 % in 1916 to 90 % in 1917-1918.

In addition, from 1916 to 1918, the proportion of 3-furrow ploughs has increased, while that of 2-furrow-ploughs has decreased, a fact that agrees with the owners' opinions, for, in 1916, they considered that the 3- or 4-furrow plough was better suited to the conditions holding in the corn belt than the 2-furrow one. In Illinois, 71 % of the tractors are recorded in 1917-18 as towing 3-furrow ploughs, while, previously, 3 times as many 2- and 4-furrow ploughs were used as at present; 11 % of the owners recommended

2-furrow ploughs for power traction, and 13 % recommended 4-furrow ploughs, while 76 % (or more than $\frac{3}{4}$) recommended 3-furrow ploughs.

The average sizes of the farms on which tractors hauling 2- 3- and 4-furrow ploughs are used, are, according to the inquiry, 180, 250 and 300 acres respectively. To obtain complete satisfaction, a tractor of suitable power must be bought. A tractor with too low a power for the work cannot give satisfaction and its replacement by another of suitable power will lead to expense that could have been avoided had a tractor of the right size been bought in the first place.

Three or 4-furrow ploughs appear to be the best suited to a tractor on an average Illinois farm; with them ploughing can be done much more quickly than with horses. As a general rule, it is better to make the mistake of buying too powerful a machine rather than buy a too low-powered one, but this should not be taken as advice to buy big tractors.

PRICE. — Tractor prices have advanced considerably during the last two years. The average prices paid in Illinois in 1917 were: - \$800 for tractors with 2-furrow ploughs; \$1100 for tractors with 3-furrow ploughs; and \$1400 for those with 4-furrow ploughs. The average price of the ploughs were respectively \$115, \$165, and \$235. At the beginning of 1918 there was a further appreciable increase in prices.

LIFE. — The data obtained in the enquiry show that it is estimated at from 7 $\frac{1}{2}$ to 8 years.

DAYS OF WORKS PER YEAR. - - An average of 45.

REPAIRS. — The total cost for repairs varies according to a large number of factors the most important of which is the care the owner takes of his machine whether working or not. Many tractors are repaired by the makers during the first year of service, unless it is the fault of the driver that repairs are needed. Out of 140 tractors used for one season (an average of 9 months), 38 needed no repairs; the others needed repairs costing from a few cents to \$100 and amounting to an average of \$22, which gives an average for the group of about \$15. The average cost of repairs for 158 machines, having been 20 months in use on the average, was \$30, while it was \$79 for 34 machines of an average age of 32 months. The figures quoted thus show, as the average cost of repairs for the first 3 years of service, a proportion of 3 % of the first cost, a proportion that increases afterwards, as is the case with most agricultural machinery. For the latter, the average repairs are estimated at 4 %, and it is not improbable that the average for tractors should be slightly higher.

WORK DONE PER DAY. - - From the information obtained, the area ploughed per day (actual work of 10 hours) with the tractors most commonly used is 6 $\frac{1}{2}$, 8 $\frac{3}{4}$ and 10 acres respectively. These figures correspond, for 2- and 4-furrow plough tractors, with the data for 1916 published in *Farmers' Bulletin* No. 719 for the same tractors, but the actual average area ploughed per day by tractors with 3-furrow ploughs is increased by about half an acre. It is remarked that many farmers overload their tractors by hauling ploughs having one mould board more than the number for which the tractors were built, thus reducing the speed and causing the wheels

to slip. Besides these disadvantages, comparison between overloaded tractors and those hauling the normal number of ploughs for which they were made shows that, for the former, repairs cost more, more time is lost and their life is shorter. On the other hand, the average fuel consumption per acre is less for tractors having a mouldboard over the normal number; the average area ploughed per day, owing to the greater width, is $1\frac{1}{4}$ acres, but the depth ploughed is not as great as with tractors hauling the regulation number of ploughs. A tractor should not be overloaded save in the exceptional case when finishing the work makes it necessary. In the corn belt, the chief work of tractors is ploughing and sowing; only 20 % of the farmers use their tractors for road haulage.

WORKING COSTS. -- The 1917 inquiry shows that 50 % of the tractors run on paraffin; those that are built specially to burn paraffin give very satisfactory results, especially from the economic point of view, as paraffin costs about a half less than petrol. The cost of paraffin for ploughing 1 acre was 25 cents, whilst petrol cost 50 cents per acre.

Lubricants cost, on an average, 7.25 cents per acre. As has been said above, the inquiry estimates the cost of repairs at 4 %. As regards depreciation, taking as basis an average life of $7\frac{1}{2}$ years, it would be, on an average, \$106.76, \$146.67 and \$186.67 respectively for tractors towing 2-furrow, 3-furrow and 4-furrow ploughs, according to the average buying prices quoted above.

In the inquiry it is stated that relatively few of the owners employ paid drivers, and if they do the wages vary a lot. In order to find the average cost of labour per acre, the cost of paid labour was estimated at 3 dollars a day. It is pointed out that the cost of ploughing per acre with a tractor is approximately the same as that with horses, except as regards the cost of labour per acre which is, on an average, lower with a tractor.

As regards the quality of the ploughing, more than 50 % of the owners are of the opinion that it is better done by tractors than by horses; less than 3 % hold a contrary opinion. In Illinois the average depth ploughed is 6.9 in. with tractors and 4.2 in. with teams. Although the greater depth is generally supposed to improve the quality of the ploughing, it does not appear to have had any marked effect on the yields.

The authors discuss the necessity, for any farmer wishing to buy a tractor, of being well acquainted with its mechanism and how it works, and keeping it in very good condition.

The inquiry shows that, as regards horse-breeding, tractors have not had a very marked effect on the proportion of breeding mares in the corn belt.

II. — Results of an inquiry made, in 1917-18, in the state of New York, dealing with 250 tractor owners with experience in the use of these machines. It shows that the use of tractors is extending more and more in the east of the U. S. A.

Tractors hauling 2-, 3- and 4-furrow ploughs are mostly used. The most numerous are those hauling 3-furrow ploughs; they seem to be particularly favoured by farmers having farms of 151 acres or more.

This inquiry, like the preceding one, shows that, with a tractor, the work can be done, not more cheaply than with horses, but more quickly. The average life of a tractor is $8\frac{1}{2}$ years; 75 % of the tractors in the state of New York run on paraffin, while all are started on gasoline.

Only 18 % of the tractors are driven by paid men, and the wages vary greatly. Before the tractors were bought 1321 horses (including mares) were employed on the 250 farms studied; after buying the tractors, the numbers decreased to 1018, that is, by 303 animals, or 1.2 horses per tractor.

Detailed statistics on the cost of ploughing with a tractor show that it costs about the same as ploughing with horses. Out of 217 owners, 185 (85 %) think that with a tractor there is a saving of paid labour; 57 of them gave the total saving, which was, on an average, \$213 per year, which represents 71 working days at \$3 a day.

354 - The Tractor-Making Industry in the U. S. A. — FAWCETT W., in *Farm Implement Trade*, Vol. XXXIX No. 10, p. 18 Chicago, November 11, 1918.

The federal Department of Agriculture has just finished an inquiry into the output of 240 firms that make tractors. Out of the 240 firms 40 were preparing to make tractors, so that the following figures represent the output of about 200 tractor makers.

In 1916, 29 670 tractors were made in the U. S. A., while 62 742 were made in 1917 and 58 543 in the first half of 1918, which gives a total of 150 955 tractors made between January 1, 1916, and July 1, 1918.

In 1916, the number of tractors sold in the U. S. A. was 27 819; no figures are given showing how many were exported. In 1917, the number of tractors sold in the U. S. A. was 49 504, and 14 854 tractors were sold to exporters. The exports seem to have increased by 100 % in 1918, for the number of tractors exported during the first half of that year had reached 15 610.

In August, 1918, there were 11 388 tractors available either at the works, shipped or delivered to the agents. From the census of the tractor-making industry very interesting data were obtained on the production capacity of the makers and also on the probable output in 1919, but the information collected on this subject is not published for the present.

The chief obstacles that hinder the development and sale of their machines by tractor makers are stated to be the lack of capital, labour, raw material and transport facilities.

355 - Soil Packing by Tractors. — RINGELMANN, M., in the *Journal d'Agriculture Pratique*, Vol. 82 Vol. XXXI No. 24, p. 160, Paris, November 8, 1918.

The packing of the soil by tractor wheels is all the greater the more the soil is wet and the greater the pressure of the wheel per centimetric breadth of the tyre. On the other hand, the water content of the soil increases with the depth (1).

(1) Figures on this subject will be found in the notes by M. J. DUMONT, Director of the Grignon Agricultural Station, in the *Annales de l'École d'Agriculture de Grignon*, Vol. VI (1915-1916), (Anthon).

Great pressure (65 kg. per cm.) applied on the surface of a medium loam soil before ploughing is felt down to a depth of 10 cm., and has a bad effect on plant growth, while no such consequences were noted when the pressure was 33 kg. per centimetre of tyre width. The bad effects of a moderate packing of the surface soil are in great part destroyed by the splitting-up that follows owing to the earth being turned over by the plough. When the packing acts on the bottom of the furrow, which is always moister than the surface layer of soil, it cannot be remedied by any subsequent cultural operation.

In very light soils, with a low clay content, that is, not very tenacious, packing the bottom of the furrow should not have any serious consequences to the crop; it has probably none at all in wholly sandy soils. In sandy loams and loams, local packing at the bottom of the furrow prevents the normal development of the roots. For a first period the vegetation covers the soil uniformly, but after a period of varying length, those zones that correspond to the compressed strips are retarded in their growth, as the roots come up against the solid wall formed by the packed areas and are only able to utilise a depth equal to that of the furrow slice, while between these compressed zones the plants grow more vigorously as their roots can penetrate deeper than those limited to the depth of the packed area.

The same thing happens if the strips form a kind of continuous flooring at a certain depth when parts working with a rotary motion, and whose speed at the circumference is greater than the speed of forward movement, slip at the bottom of the depth being worked.

356 - Tests of an 8-16 H. P. Avery Tractor in New Zealand. - *The New Zealand Journal of Agriculture* Vol. XVII, No. 1, p. 193 Wellington, October 21, 1918

In September, 1917, the Department of the Central Development Farm, at Weraroa, New Zealand, bought an 8-16 H. P. Avery tractor. The director of the farm states that the tractor gave satisfaction both for driving the fixed machinery and for work in the field. From October 8, 1917, to July 31, 1918, the tractor ploughed an area of 235 acres, with an average of a little more than 3 acres a day, including time lost in attending to it, moving it from field to field and delays while stumps and stones were removed. In a good sized field 5 ½ acres could be ploughed per day of 8 hours. For 26 days, without interruption, 101 acres were ploughed with a consumption of 1 ½ gallons of "Powerin" per acre; the total consumption was 1 ¼ gallons per acre on an average.

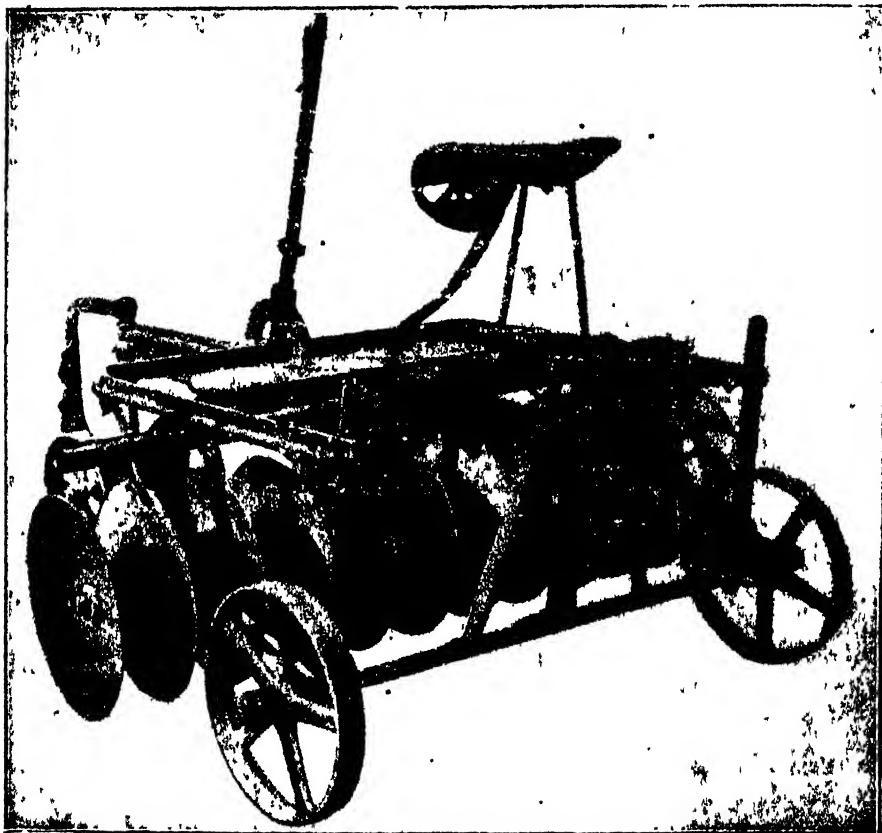
The tractor together with its plough was managed by one man. The field work consisted in ploughing, but the tractor had also been used:— for 9 days for grinding wheat, oats, barley, etc.; 19 days for chopping straw; 15 days for threshing; 3 ½ days for cutting silage; 4 days for cutting wood. The driver filled up this time with teams when the tractor was not being used. The cost of repairs for the year amounted to £28.

357 - The New "Cestro" Disc Harrow. - *The Implement and Machinery Review*, Vol. 41, No. 53, p. 757 + 1 Fig London, November 1 1918

Messrs. J. W. PROCTOR & Co., Ltd., Cestro Works, Chesterfield, Eng-

land, make an improved type of disc-harrow, shown in the appended figure. The improvements consist in a quick, easy and certain method of regulating the depth to which the machine works and adapting it to transport.

Behind the machine, and at right angles to the line of traction, there is a supporting axle on two wheels. On the inner side of these wheels are two vertical bars pierced with holes to receive the keys that hold the rear corners of the main frame.



Messrs. J. W. PROCTOR & Co's "Centro" disc-harrow.

At the centre of the axle there is a vertical rack on which a toothed pinion moves upwards and downwards, worked by a helical wheel provided with a handle. By changing the keys and turning the handle, the trailing wheels can be adjusted to the required depth, so that in this way the driver can regulate the work done by the discs and avoid their penetrating too deeply or unequally in the soil, and thus assure a fine, even seed bed. A few turns of the handle lift the discs from the soil and prepare the machine

for transport. The main frame of the machine is square, made of angle-irons and bolted on the top middle girder of the machine and is made to support the discs, which are hung across, thus giving great rigidity to the machine which is built specially for farmers who work with only two horses and whose land is more or less undulating. By setting the discs for the greatest depth when going down the slope of the field and raising them 2 or 3 inches above the ground when going up, the work will be done very well.

358 - Machines for Treating Oil-Palm Fruits. — I. STELLINGSMA, A, Machines for preparing palm kernels and palm oil, in the *Institut Colonial de Marseille, Bulletin de la Section de Matières Grasses*, No. 6, pp. 341 + 41 Figs., Marseilles, 1918. — II. FICKENDEY, The mechanical treatment of oil palm fruits. *Phil., Subbliment*, pp. 15.

I. — **MACHINERY FOR PREPARING PALM KERNELS AND PALM OIL.** — The author considers the problem of the mechanical extraction of palm oil from two points of view: — 1) the construction of small, cheap, easily transportable machines that can be worked by hand and moved from place to place according to the needs; 2) the establishment of central works treating large quantities of fruits by means of heavy, power-driven machinery. The author has utilised the documentation published by the Imperial Institute at London and that gathered together by him at the Colonial Institute at Marseilles.

Two *hand machines*, that of GWIRA and that of PHILIPPS, very similar in principle, have been patented for preparing palm oil. In both of them the fruits are placed in a cylinder with warm water and subjected to the action of beaters, the oil and water then flowing through a sieve.

Mr. EVANS has made trials, on the Gold Coast in 1910 and 1912, with the GWIRA machine, of which the author gives a detailed description illustrated by several figures. In the 1912 trials, which were probably made with a modified type of the GWIRA machine described by the author, the percentage of oil extracted varied from 13.75 to 16.25, while the fruits contain 22 % of oil, according to the examination made at the Imperial Institute. A specimen of residual pulp was also examined at the Imperial Institute and found to contain 36 % of oil.

It thus appears very mediocre, given that the residue obtained by using the ordinary native methods contained 31 % of oil. This incomplete extraction is probably due to the fact that the pulp is not pressed. The oil produced by this machine is of good quality. It would be a "tender" oil with 10.4 acidity only, according to the Imperial Institute. The improved PHILIPPS machine (British patent No. 18370 of 1912) was shown at the International Exhibition of Rubber and Tropical Products held in London in 1914. At that time it cost £ 5. The percentages of oil extracted by that machine are not given.

POWER-DRIVEN MACHINES. — A certain number of different machines have been invented and made to carry out certain operations, such as removing the fruits from the clusters, separating the pulp from the fruits (depulping or depericarping machines), breaking the nuts, and also complete plant for preparing the oil and kernels. In nearly all the methods, the first

operation consists in removing the fruits from the clusters. The fruits make up about 64 % of the weight of the clusters, the residue consisting chiefly of fibrous stems the presence of which would be an obstacle in the extraction of the oil. The fruits can be removed by beating the clusters with a heavy beater or against the ground, but at least two machines have been invented to do this: — the HAWKINS machine (treating from 25 to 30 clusters per minute and per basket) and the LUTHER machine from Brunswick, Germany (treating about 10 metric tons of clusters in 10 hours); the author briefly describes these two machines.

The methods used after separating the fruits from the cluster can be divided into two classes: — 1) those in which the entire fruit is pressed without removing the nuts; 2) those in which the pulp is separated from the nuts and pressed by itself. In addition, it has been suggested that the whole fruits, including the nuts, should be crushed and pressed so as to obtain a mixture of oils (COOKSON process, British patent No. 14 728 of 1911, which does not appear to have been used in practice). It is probable that the mixed oil thus produced would not easily find a buyer in Europe, while the residual cake, containing much fibre, could only be used as fuel or manure.

As regards the processes in which the whole fruit is pressed (without breaking the nuts), the author describes: — a) the FOURNIER plant (1) including cooking vats for heating the fruits by steam, presses and drums to separate the fibres of the nuts (defibrator), and, in addition, a POISSON crusher (used for crushing the nuts after drying). An installation of this type has been installed in Togoland by the firm of KRUPP of Magdebourg-Buckau and costs, with accessory machinery, the sum of 25 934 marks, according to the invoice. Another application of this system has been made in Dahomey in a works directed by M. POISSON; b) the "Agupflanzung" plant. The Germans appear to have studied the application of machinery to the treatment of oil-palm fruits in the most exhaustive fashion, especially at Agu (Togoland) and at Maka (Cameroons). The clusters are submitted, in a double-walled, steamheated recipient, to the action of heavy stamps which are prevented from touching the bottom of the recipient by blocks of rubber. The stamps separate the fruits from the clusters and crush them completely, breaking the oil cells, the nuts remain intact (as the space between the lowest point of the stroke of the stamp and the bottom of the cylinder is calculated for this). After stamping only a single pressing is needed, while all the other dry processes require two pressings. The stamped mass (clusters, pulp and kernels) fall into a steam-heated recipient and then pass into a hydraulic press giving a pressure of 250 atmospheres. The pressed oil is then allowed to separate in a decantation tank, after which it is isolated from the rest of the water and other impurities by boiling in large steam vats. The residues after pressing (clusters, fibre, nuts) pass through a sieve which retains the clusters. The fibre and nuts are passed through

(1) This is described by M. JEAN ADAM in his work "*Le Palmier à Huile*" (The Oil Palm), published by Challamel, 1910. (Author).

a sieve-drum made by LUTHER, through which the fibres pass while the nuts pass to the end. From the defibrating drum, the nuts pass to an externally heated drying drum and they are then crushed in HAAKE crushers working by centrifugal force. The kernels and broken shells pass through a sieve-drum where the small pieces are removed, then into a salt bath, where the kernels float. The kernels are afterwards dried in the sun.

The firm of HUMBOLDT suggests replacing the salt bath by a machine; researches in this direction appear to promise good results. An oil palm factory of this type costs about 70 000 marks, including a portable steam engine. It deals with 8 metric tons of fruits in the clusters or 10 metric tons of detached fruits per day of 10 hours. In Togoland, 10 % of oil and 10 % of kernels are obtained. The oil contains from 5 to 6 % of fatty acids, a maximum of $\frac{1}{2}$ % of impurities and only traces of water. M. HUPFELD reckons that a factory requires one white mechanic, one black mechanic, and 15 to 20 workmen, not including those required for gathering and transporting the fruits.

The author also describes the process and machine that Mr. ISAAC THOMAS HAWKINS (Civil Engineer, 63 St. James Street, London) patented (No. 141,38 of 1912).

Next the author considers the mechanical processes for removing the pulp from the nuts before pressing. The various depulping and crushing machines actually in use are described, figures being appended to illustrate the text.

Depulpers. — The authors specially mentions: — the HAAKE (of Berlin) machine, that of BUCHANAN and TYRELL (British patent No. 103,35 of 1911); that of C. H. DYER and C. INNIS-WARD, of LONDON, for decorticating palm kernels; that of H. G. FAIRFAX and CRAIG, made by Mr. A. F. CRAIG of Paisley, Scotland, who supplies the complete plant for preparing palm oil. This process is called the "Caledonian dry process" (the fruit is neither stoved nor boiled in water before expressing the oil; as the oil is never in contact with water, no glycerine is lost, even if there is development of fatty acids and production of glycerine in the case of over-ripe fruit). The CRAIG dry pulpers treat 250 kg. of fruit per hour. The CRAIG plant includes: — hydraulic presses for pressing the pulp in the cold; a special drier for drying the fruit in the wet season and also the nuts to facilitate the separation of the kernels and shells; a centrifugal crusher combined with an oscillating separator which separates the kernels from the broken shells in the dry state. The author mentions the following firms as dealing with depulping plant. — A. OLIER, of Argenteuil, France (2 models, one of 25 H. P. and one of 12 H. P.; without the boiler and machine, plant to treat 5 metric tons of fruit in 10 hours had a pre-war price of 25 000 francs, and that for treating 10 metric tons 37 000 francs); LOUIS LABARRE, of Marseilles (no details given as to the depulping machine, and, in the estimate for complete installations, the crusher is not mentioned, the pre-war prices were 28 000 fr. for machinery treating $2\frac{1}{2}$ metric tons in 10 hours, and 37 000 fr. for treating 5 metric tons; the latter plant requires from 25 to 30 H. P.); Messrs. MANLOVE, ALLIOT & Co.,

of Nottingham, also make a depulper about which the author has no information.

The author quotes the text of a patent (May, 1914) machine for depulping invented by Mr. W. E. J. TREVOR which is used by the Pericarp Syndicate of the Ivory Coast.

Breakers. — The best results appear to have been given by breakers using centrifugal force, but they have to run at a very even speed, which is difficult to obtain in Africa. When the breaker runs too quickly, the kernels are broken as well as the shells; when it runs too slowly, a large proportion of nuts escape being broken. The author gives descriptions with figures of the following breakers: — MAAKE, of Berlin; MILLER BROS., of Liverpool; POISSON (France); JOHNSTON (Liverpool); DOWNIE CRELIN (made by MILLER BROS, of Liverpool); DREWS; HIND & LUND (Preston); DYER and INNES-WARD; CRAIG and Co. (Paisley, Scotland).

After breaking, the broken shells must be separated, which can be done either by hand or by using a salt bath of suitable density, in which the kernels float and the shells sink to the bottom. With this method the kernels have to be washed and dried, without counting the cost of the salt. The various oscillating and rotary sieves that have been invented do not do away with the need for the salt bath.

An ingenious machine was patented in 1914 (British patent No. 24249) by Messrs. SMITH, MATHER and PLATT for carrying out the separation; the author gives two figures of this machine.

Besides describing the machinery for dealing with palm kernels the author includes M. ANNET's report on the industrial extraction of palm oil in the Cameroons. This report describes: — 1) *the management of the Maka factory*, built by the side of the North-Cameroon railway at the twelfth kilometre on a river with a steady flow; it consists of 3 buildings: the power house, with two steam engines, one of 175 H.P., and one of 75 H.P.; the oil works, a large, 3-story, reinforced-concrete building, with all the machinery needed for extracting the oil; and a large storehouse; the cost of the buildings was 250 000 francs and the machinery cost 300 000 francs; 2) *the treatment of the fruit*; the clusters are dealt with by hand in the works, then beaten, after which they are sorted to separate the fruit; the fruits are carried to the third floor by an elevator and distributed mechanically in special vats furnished with steam coils, where they are cooked. They next pass automatically to hydraulic presses placed on the floor below; the oil extracted flows into decantation tanks placed lower down, where it undergoes a first purification with steam; it now passes to the bottom floor where it is receives a final purification and filtration. The pressed fruits are deposited in octagonal drums, where the palm nuts are freed from their fibres; they are cooked again, then submitted to heavy pressure; the cake obtained is taken to the furnace where it is mixed with fuel. The palm nuts are placed for several days in a current of warm air which is sufficiently hot to dry them and prevent the kernel from sticking to the shell; they then pass through the HAAKE breaker. The unbroken nuts are separated from the broken ones and sent through the breaker again; the

broken nuts pass into a salt bath ; the kernels float and are removed, dried, and placed in sacks ; 3) *the yield* ; 100 kg of fresh fruits yield from 16 to 18.5 kg. of palm oil, from 16 to 20 kg. of kernels, about 20 kg. of fibre and about 40 kg. of shells. The kernels are treated industrially in Europe only ; they contain 40 % of oil ; the remaining 60 % is used as a cattle cake or as a fertiliser ; 4) *methods of supply* ; products of the plantations and products bought on the spot ; 5) *the staff* : 1 director, 3 accountants or clerks ; 3 engineers ; 4 works overlookers ; 3 plantation overlookers, 8 separate officials in the stores, with a total of 22 Europeans ; the native labour consists of 400 workmen in the factory, 100 labourers in the store-houses and about 3 500 labourers spread about the different plantations.

II. - The Governor, M. L. TOURNEAU, publishes the translation of a report by Dr. FICKENDEY in the *Journal Officiel* of the Occupied Territories of the Former Cameroons. The conclusion reached in this report is that the problem of the mechanical treatment of oil-palm fruits can be considered as resolved, but every attempt must be made to improve the process and lower its cost, while increasing the yield and quality of the product.

In his report, Dr. FICKENDEY deals with : — the storage of the cluster ; the separation of the fruit from the clusters ; the cleaning of the separated fruit ; the treatment with heat to destroy the enzymes that decompose the fatty matter (to do this the fresh fruit is placed in a steam-jacketed cooker provided with stirrers ; the fresh fruit treated in this way has a fatty acid content of 7.8 %, while fruit that is first steamed and fruit that is boiled first have a fatty acid content of 4.9 and 4.1 %) ; the mechanical separation of fruit from pulp (which should be done after the first pressing ; this separation of the pulp is carried out perfectly by the peeling machine of the GRUSON works at Mokundangé) ; the first pressing (with a fixed-body hydraulic press) ; the separation of the pulp from the fibrous mass (KRUPPS' rotary drum has given good results, but, at AGOU, there is a machine which works continuously, while the KRUPP machine works intermittently ; this machine might be improved and would then prove a serious competitor with the KRUPP drum) ; the drying of the nuts ; the breaking of the nuts (the HAAKE breaker does its work well, but the Mokundangé factory owns a machine built on different lines, which gives excellent results) ; the separation of the kernels from the shell ; the second pressing of fibrous mass ; the refining of the oil ; the decolourising or blanching of the oil ; the Agou method described concisely above ; the yield (in the Cameroon factories about 12 % of kernel and 15 % of oil are obtained ; the Awewe factory, on the contrary, gets a yield of about 17 % of oil and 17 % of kernels) ; the cost price (in Togokand, they reckon 25 marks as the cost of preparing a metric ton of fruit separated from the clusters ; the same figure is arrived at in the Cameroons.

359 - **Motors for the Fixed Farm Machinery.** — ROLLA, in *La Vie Agricole et Rurale*, Year VIII, No. 49, pp. 117-118 + 6 Fig. Paris, December 17, 1918

After having considered the advantages of motors, the author studies

the various types of engine used to drive the different machines that do the indoor work of the farm. From technical and economic considerations the internal-combustion engine, whether using petrol or benzol, is the most important in many cases, as it can be so easily installed, occupies so little space, on a bed, bracket or trolley (in this case it can be moved to the apparatus or the transmission system that requires to be driven), easy starting, requires little attention, etc. For the dairy industry, the engine should be placed in a separate room, and the place where the transmission passes through the wall between engine room and dairy should be fitted with a wooden casing to prevent injurious gases passing into the dairy. As indoor farm machinery runs at a relatively, slow speed, an engine with a small angular speed should be chosen. If quick-running engines are used, reduction transmission should be put in to reduce the speed. Great speed means rapid wear, thus reducing the life of the engine and increasing the consumption after a certain time. Delicate machinery like separators should be started by hand if possible or, if not, by means of the usual device that allows the belt to slip partially on the pulley. When the engine is mounted on a trolley, it can be easily moved about if the machines are not conveniently near together. But if there are many machines at some distance apart, and which have to run at the same time it would not pay to get a number of engines and, in this case, a steam engine or an internal-combustion engine (especially those running on "poor" gas) should drive one or more *electro-generators* to supply current to electromotors driving the machines in the dairy, cider room, wine storeroom, etc. As regards this, the author suggests that, if a 5-6 H.P. internal-combustion engine is already available, the procedure to be followed could be like that indicated by M. L. MARRIN at the "Académie d'Agriculture" when he communicated the results of trials with a 6.75 H.P. shunt generator running at 1600 revolutions and a 1.25 H.P. shunt dynamo, with a speed reducing-gear mounted on a trolley or handcart giving a speed of 185 revolutions per minute at the counter-shaft; these results were as follows:—strawcutter: power required 1.6 H.P.; average strength of current required, 12 amperes; cost per hour: 57 centimes, with current at 40 centimes the kilowatt—root-chopper: 1.3 H.P., 10 amperes, 48 centimes—root-washer: 0.5 H.P., 4 amperes, 19 centimes—fertiliser crusher: 1.3 H.P., 10 amperes, 48 centimes—cake-crusher: 0.6 H.P., 5 amperes, 24 centimes—grain crusher: 0.4 H.P., 3 amperes, 14 centimes—winnowing: 0.6 H.P., 5 amperes, 24 centimes. Very convenient electro-generating sets can be bought in which the internal-combustion engine is placed with the generator. Given its advantages the electric motor is quite indicated if an electricity company supplies the farm with current; it is also advisable if water power is available.

The "poor" gas engine is the most economical internal-combustion engine, but, like the steam engine, it takes some time to start it; it is most suitable and especially economical in those places where it has to run continuously.

The author next deals with the power of the motor and he advises the

would-be buyer to visit a farm plant so as to see what power is actually required before buying. Generally speaking an average butter-making, dairy requires from 3 to 4 HP. A separator taking 3 000 litres per hour requires 1.5 HP.; one of 4 000 litres, 2.5 HP.; large butter workers, 1-4 HP. Some small freezing machines can be run with 1-4 HP. electric motors. Four HP. are required for a food-mixing room, including a mill, crusher, furze crusher, root-pulper, fresh-bone cracker. If an electric motor is used, the transmission must be doubled as the various machines run at very different speeds.

The author gives figures which he has checked on various farms showing the electric current measured at the generator required for various machines, such as the PROTTE thresher, root-choppers, straw-choppers, etc.

Various installations set up in different parts of France representing the different types of farming and using different types of engines for driving the indoor farm machinery are described, plans being given as illustrations of the various types.

360 - **Protection against Fire on the Farm.** — MICHOTTE, P., in the *Comptes rendus de Sciences de l'Académie d'Agriculture de France*, Vol. IV, No. 37, pp. 1022-1017. Paris, November 27, 1918.

Information on preventive measures against fire and the organisation of fire fighting in villages.

The first measure that should be taken in any place is to build, fire-proof buildings. For instance wooden buildings should be given a coating of plaster and not treated with fire-proofing substances, which is a useless procedure.

No fire-extinguishers of any kind are of any value; they have never extinguished anything, according to the author, who thinks their sale, like that of fire grenades, should be prohibited. The carbonic acid contained in the water in the extinguisher has no action whatever. If it could extinguish a fire, no fire would be possible, as any burning body gives off torrents of carbonic acid; thus, 1 kg. of burning wood gives off nearly 3 cubic metres of carbonic acid gas. The same applies to devices using tetrachloride of carbon (which only extinguishes burning oils and paraffin in faked experiments, like the previous ones) and extinguishing powders.

Instead of having recourse to fire-extinguishers, either a hand or motor pump (every farm ought to have one at least) should be used; then, all that is necessary is to put a special connection on the high-pressure main and have a canvas hose sufficiently long to reach the different parts of the farm buildings.

361 - **The Future for Agricultural Machinery in Syria.** — *The Engineer*, Vol. CXXVI, No. 3252, pp. 429-430. London, November 22, 1918.

A study made by the late special British Commissioner in the Near East on the importance and kind of markets that might be available for British trade in Syria.

The agriculture of this country might become very prosperous, but considerable irrigation schemes need to be carried out in order to provide

against the frequent droughts. Shortly before the war the Turkish Government had projected a vast irrigation scheme that was to be carried out by an English company at a cost of 18 to 20 millions sterling. Though the late Government was not in a condition to complete such an undertaking for financial reasons, now the project could be carried out, if not completely, at any rate partially.

Only a very small proportion of the cultivable area of Syria has been turned over by the plough. The great plains of the districts of Aleppo, Damascus, Hama, Homs and Hauran, like the more southerly regions going as far as Gaza, are hardly cultivated at all and, in those places where agriculture is carried on, it is still by means of the most primitive methods. Modern agricultural machinery is unknown and the Syrian farmer depends on the rainfall to supply his crops with the necessary moisture. The Gouvernement attempted to spread the use of agricultural machinery by establishing show-rooms containing all kinds of farm machinery, and open to the inspection of those interested, in the chief agricultural centres of the Ottoman Empire, including Homs, Aleppo, Damascus and Beirut. The machinery shown was all of either American or German make. The German ploughs were made either by ECKART or RUDOLPH SACK, they weighed from 35 to 96 kg., and the prices varied from 1 to 3 pounds of Turkish money (1 *Turkish pound* = 22.784 francs, *at par*). Interesting notes are given on the various local ploughs in use. To satisfy the Syrian farmer it will be necessary to introduce ploughs resembling the native ones, which are cheap and easily made. Information is given as to hand pumps for domestic use and motor-driven centrifugal pumps for irrigation.

362 - **Review of Patents.** — CANADA — DENMARK — NEW ZEALAND — SWITZERLAND — UNITED KINGDOM — UNITED STATES: *Sources, see Review, Jan 1910, No 104*

TILLAGE MACHINES AND IMPLEMENTS. — *Canada*: 186572 Harrow mechanism.

Denmark: 23808 Combined harrow and leveller.

Switzerland: 801,5 Motor plough.

United Kingdom: 119930 Plough.

United States: 1280206 Plough scraper; 1280271 Plough attachment, 1280361 Rotary harrow; 1280793-1281339-1283650 Ploughs; 1280894-1281358-1285089-1285514 Harrows; 1281283 Detachable plough point; 1281324 Disc harrow; 1281546 Agricultural machine; 1281676 Harrow attachment for plough; 1281910 Land levelling machine; 1282377-128299 Motor ploughs; 1282817 Cultivator; 1284089 Device for the vertical adjustment of the frame of a motor plough relatively to the steering wheel; 1284675 Engine gang plough; 1285171 Plough for tractor.

DRAINAGE AND IRRIGATION. — *United States*: 1280480 Tree irrigator; 1280518-1280701-1284318-1284447 Ditching machines.

MANURES AND MANURE DISTRIBUTORS. — *Denmark*: 23729 Self discharging manure trailer.

New Zealand: 40474 Manure and seed distributor.

United Kingdom : 119956 Manure and seed distributor.

United States : 1280674-1282946-1282947 Straw spreaders ; 1281363 Process of making calcium cyanamide and by-products from phosphate rock ; 1281449-1283183 Fertiliser spreaders ; 1282854 Manure spreader ; 1284131 Fertiliser attachment for agricultural implements ; 1284667 Manure loader.

Drills and Seeding Machines. — *Canada* : 186067 Hand seeder.

Denmark : 23778 Grain feed regulating device for various agricultural machines ; 23872 Machine for planting seedlings and potatoes.

New Zealand : 40474 Manure and seed distributor.

United Kingdom : 119956 Manure and seed distributor ; 120129 Potato planter.

United States : 1280468-1282124-1282126-1282798-1284290. Seed planters ; 1280546 Seed hopper ; 1281325-1284589 Grain drills ; 1282648 Seed planting mechanism ; 1283892-1285327 Potato planters ; 1284626 Means for attaching discs to planters.

VARIOUS CULTURAL OPERATIONS. — *United States* : 1280353-1280545-1280610-1283132-1283974-1284617-1285551 Cultivators ; 1281235 Cultivator attachment ; 1281963 Foot pressure distributor for two-row cultivator ; 1282677 Tree protector ; 1282776-1284075 Cotton choppers ; 1283664 Cotton and sugar beet chopper ; 1284011 Expanding hoe ; 1284208 Cultivator shield.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Canada* : 185968 Animal trap.

Switzerland : 80063 Small butterfly destroyer ; 80064 Insect trap ; 80178 Caterpillar trap.

United States : 1280231-1283811 Quack grass diggers ; 1282277 Implement for destroying insects ; 1282697 Powder dusting machine ; 1283053 Insect trap ; 1284698 Boll weevil exterminator.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada* : 185903 Lawn mower.

Denmark : 23752 Binder sheaf counter ; 23922 Grain saving attachment for binder.

Switzerland : 80060 Mower.

United States : 1280378 Fodder shocker ; 1280671 Kafir corn header ; 1280686 Maize stalk cutter and loader ; 1280842 Cow pea harvester ; 1280985 Mower dump seed pan ; 1281002 Grass receiving attachment for mowers ; 1281081-1283541 Maize husking machines ; 1281111 Attachment for mowing machine ; 1281133-1283816 Hay rakes ; 1281464-1283203 Bundle carriers for binders ; 1281477 Hay sweep ; 1281582 Harvesting and threshing machine ; 1282031-1285005 Maize harvesters ; 1282045 Machine for harvesting grain ; 1282308-1282545-1282883 Grain shockers ; 1282422 Combined harvester with straw spreader ; 1282973 Pea picker ; 1283277 Cotton picker ; 1283325 Grass catcher for lawn mower ; 1283414 Scythe ; 1283474-1283674 Side delivery hay rakes ; 1283475 Rotary hay rake ;

1283721 Two row maize harvester ; 1283807 Sickle bar for cutting peppermint ; 1284567 Portable detachable tongue for harvester , 1284737 Bean harvester ; 1285090 Maize cutter , 1285166 Butter for grain binder.

MACHINES FOR LIFTING ROOT CROPS. -- *Canada* : 185956 Plant digger , 186208 Harvester for roots.

Denmark : 23779-23894 Turnip digger.

United States : 1280156-1282313 Beet toppers ; 1280207-1281066-1283641-1283810-1284449 Beet harvesters ; 1281509 Potato digging machine ; 1282205 Beet conveying mechanism for beet harvester ; 1282462-1282657-1285529 Beet harvesters and toppers.

THRESHING AND WINNOWER MACHINES. — *Canada* : 185945 Screen for grain ; 186332 Grain elevator.

Denmark : 23744 Device for threshing machine , 23777 Device for fixing the sieve to a winnowing machine ; 23839 Sieve device, for threshing machines.

United States : 1280446-1280600 Seed separators ; 1281082 Machine for removing butt ends of ears of maize ; 1281582 Harvesting and threshing machine ; 1282422 Combined harvester with straw spreader ; 1284246 Flax thresher.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada* : 185930 Grain pickling apparatus ; 185965 Sheaf loader , 186330 Straw stacker ; 186685 Hay compressing machine.

Switzerland : 80176 Berry press.

United States : 1280211 Feeder for ensilage cutter ; 1281598 Hay cutter ; 1282312 Peanut blanching machine ; 1283494 Hay loader ; 1283498 Hay or grain carrier and elevator ; 1283512 Process for reclaiming seed ; 1283796 Hay spreader for barns ;

FORESTRY. -- *United States* : 1280356-1280951-1281033-1284812 Stump pullers.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *Canada* : 186263 Tractor.

Denmark : 23861 Windmill generating electricity.

• *New Zealand* : 40561 Windmill.

United Kingdom : 120217-120331 Couplings for motor tractor.

United States : 1280880-1280962-1282329-1282667-1283725-1284577-1285472 Tractors ; 1281049 Tractor trailer coupling ; 1281232-1282674-1283215-1284097-1284385 Tractor wheels ; 1282119 Motor driven plough traction wheel ; 1282327 Tractor truck mechanism (self laying track type) ; 1282328 Traction engine frame ; 1282334 Motor control gear of motor tractor , 1282683 Tractor device ; 1282827 Flexible tractor track and operative wheel therefor ; 1282894 Automobile power transmitting apparatus ; 1283083 Motor propelled tractor ; 1283129 Windmill or wind motor ; 1283199 Water power apparatus for use in connection with water falls ; 1283990 Guide device for traction engine ; 1285342-1285343 Tractor attachments for automobiles.

FEEDING AND HOUSING LIVESTOCK. — *Canada*: 186528 Stanchion support.

Switzerland: 80061 Feeding crib with movable rack.

United States: 1282758-1285440 Cattle stanchions; 1283301 Watering device for cattle; 1283503 Stock feeding apparatus; 1283567 Horse shoe; 1284355 Animal releasing device.

POULTRY FARMING. — *United States*: 1280588 Device for making hens lay; 1282440 Incubator.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada*: 186385 Flour mill.

New Zealand: 39137 Drier for casein.

Switzerland: 80092 Flour mill.

United States: 1281090-1282069 Fruit grading machines; 1281502 Vegetable cutter and slicer; 1282312 Peanut blanching machine; 1282789-1282791-1282792 Machines for cutting green maize from the cob; 1282790 Knife structure for removing green maize from the cob; 1283949 Fruit conveyor; 1284627 Sugar cane mill; 1284628 Vegetable curing plant; 1284852 Peament shelling machine; 1285560 Gravity fruit separator.

DAIRYING. — *New Zealand*: 39252 40142 Milking machines; 40135 Cream can.

Switzerland: 80228 House churn; 80229 Churn.

United States: 1280294 Milk or cream cooler; 1283343 Centrifugal separator; 1284914 Cream regulating screw for centrifugal separator; 1285079 Teat cup for milking apparatus; 1285338 Teat cup claw.

FARM BUILDINGS AND EQUIPMENT. *United States*: 1281201 Silo; 1282605 Silo door mounting; 1284699 Silo scaffold.

VARIOUS. — (*Canada*: 18599) Pump mechanism.

United Kingdom: 120060 Centrifugal pump.

United States: 1280781 Kelp harvester.

RURAL ECONOMICS.

363 - **Comparative Data on the Cost of Production of Olives in 1913 and 1918, in Apulia, Italy.** — MAURY, in the *Bollettino della Società nazionale degli Olivicoltori*, V. II, XV, No. 11-12, pp. 122-123, Rome, November-December 1918.

Sig. MAURY, a Deputy to the Italian Parliament and Vice-President of the "Società nazionale degli Olivicoltori" (National Society of Olive-growers), gives the following data on the cost of production of olives in Apulia —

Price of olive oil:

In 1913	Official price of oil for export	160 <i>liras</i> per quintal
In 1918	Price of oil fixed by scale	450 <i>liras</i> per quintal
	Increase	281 %

Cost of production of olives.

Wages and other expenses	Price in 1913, in liras	Price in 1918, in liras	Increase, %
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Regions of Apulia where olive-growing predominates:—

Men pruning the trees per day	4—5	40—55	1 050
Women gathering the olives	1.25—1.50	20—30	1 810
Boys of 12-14 years gathering the olives	1—1.25	20—25	2 000
Men loading olives on carts	3—4	30—45	1 070
1-horse cart	10—12	150—180	1 500
2-horse cart	12—15	300—400	2 590
Copper sulphate for spraying against <i>Cyclocontum</i> (1) per 100 kg	55	350	630

Regions of Apulia where olive growing is less predominant:—

Men pruning per day	4—5	18—21	406 %
Women gathering	1.25—1.0	10—15	909
Boys gathering	1—1.25	8—12	808
Men loading the olives	3—4	18—24	600
1 horse cart	10—12	100—120	1 000
2-horse cart	12—15	200—250	1 660

(1) *Cyclocontum oleaginum* Cast. = olive leaf spot. See R, May 1917, No. 438 (Ed.)

AGRICULTURAL INDUSTRIES.

364 Oil extracted from Oat Grains. VAN KAMPEN, G. B., in *Oleonen Vellen*, Vol. II, No. 27, pp. 203-204. Amsterdam, January, 1919.

INDUSTRIES
DEPENDING
ON PLANT
PRODUCTS

On account of the lack of fats of recent years, several attempts have been made to extract them from sources hitherto unutilised in the oil industry. Thus, for example, DUBOWITZ tried to extract the oil from oat grains.

While rye, wheat and barley only contain 2 % of fat, oats contain relatively much more: according to KELLNER, 4.8 %, according to WEHMER, 5.3 %, and, in certain varieties, up to 7 %. Oats resemble maize in this respect.

The oil is extracted from the decorticated grain by means of benzene, which is afterwards removed by passing steam through. In the first attempts, the oil was obtained in the state of a greenish emulsion, due probably to the presence of starch; to separate the oil, sulphuric acid was added to the oil and steam passed through. Later on, the emulsification of the oil was avoided by using a filter.

The physical constants of the oil are as follows:— Specific weight at 15° C, 0.911; Acid index, 62.1; Saponification index, 180.1; Iodine index, 91.7

The calculation of the yield has shown that the value of the oil will cover the cost of buying and extraction.

- 365 - The Use of Soya Oil in the Manufacture of Paints.** — *L'Exportateur français*, No 87, p 39 Paris, March 28, 1918. Quoted in the *Bulletin économique de l'Indochine*, Year XXI, New Series, No 132 pp 992-993. Hanoi Haiphong, September-October, 1918.

According to experiments by the National Association of paint manufacturers of the United States, the oil extracted from soya beans gives better results than any other vegetable oil as a substitute for linseed oil in the manufacture of paints.

- 366 - On the Manufacture of Neutral Palm Oil.** — LINDET (Regarding a recent paper by M. P. AMMANN), in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol V, N° 5 pp 158-159 Paris, February, 5, 1919.

M. LINDET (Professor at the "Institut national agronomique" of France) gives an account of the paper that M. PAUL AMMANN ("Directeur du Service" of the Laboratories of the "Jardin Colonial", at Nogent), just returned from a mission to the Ivory Coast, has published under the title "*Recherches sur la fabrication de l'huile de palme neutre*" (Researches on the manufacture of neutral palm oil). The author has published interesting facts relating to the neutral oils contained in the fruits of the oil-palm (*Elæis guineensis*).

It is well known that palm oils have always a marked rancidity, which is shown by a high acidity and a disagreeable odour. This rancidity is due to the fats being split up by the enzymes of the plant tissues during the development of the over ripeness to which the fruit is allowed to arrive so that it can be easily detached from the peduncles, and during the time the fruit stays in pits or vats so that it will yield the oil more easily on cooking.

The author of the above-mentioned work shows that the fruit should be detached from the stalks before becoming completely ripe and boiled at once in water. In this way oils can be obtained whose acidity is not over 0.2 %, instead of the 14 or 15 % that is not uncommonly found. Such neutral oils are quite suitable for human food.

- 367 - "Cay-sen" Oil.** — See No 318 of this Review

- 368 Process of Messrs. Maude and Crosse for Obtaining a Plantation Rubber of "standard Quality Comparable to that of Para.** BARROWCLIFF, J. I. C., in the *Journal of the Society of Chemical Industry*, Vol XXXVII, No 6 pp 95-105 T. London, March 30, 1918. Abstract in the *Bulletin économique de l'Indochine* Year XXI N° 13 pp 993-994 Hanoi Haiphong September-October 1918.

Although the quality of plantation rubber is often superior to that of Para and suffers less loss in washing and drying, a value of 33 % more in pure rubber is paid for Brazilian rubber. This preference can only be due to the regularity in the quality and cleanness of Para which facilitates industrial operations, especially vulcanisation, which can always be carried out under the same conditions. The differences in the quality of plantation rubber occur, not only in products of different origin, but in those of the same origin, of the same plantation, even when the coagulation process has been quite uniform.

These differences are due to: — the different vessels in which the latex has been put to obtain the crude rubber (sheets or slabs); the method

used to coagulate the latex (acetic acid, smoking); the mechanical treatment; the temperature of desiccation; the length of time elapsing between when the latex comes from the plant and when it is coagulated, during which time certain putrefactive changes may occur.

The inventors of the "standard" method noticed that the quality of the product is constant, whatever the other conditions may be, if sufficient time (3 days in practice) elapses before the latex is coagulated. The latex collected from one day to another is placed in cement tanks, which must be almost filled and well closed by an air-tight cover with a water-seal so as to shut in as little air as possible; putrefaction is thus avoided. It is left three days. Coagulation is then hastened by adding a soluble calcium salt. To avoid the formation of small carbonic acid bubbles a pressure of 1 to 2 atmospheres may be used. In this case the tanks must be of iron lined with aluminium. After this, whatever treatment is used, a perfectly uniform white rubber always identical, is obtained. Only the rubber from near the surface is slightly darker and opaque. With this product the duration of vulcanisation is much shorter than with Para, and the vulcanised rubber has the same tensile properties. Instead of reducing the duration of vulcanisation, the temperature may be lowered, thus further improving the quality of the finished product.

369 - Paper-Making Tests with Various Colonial Plants. — DOUROL, E. and VIDAL L., in the *Annales du Musée colonial de Marseille*, Year XXVI, Third Series, Vol. VI, pp. 1-14 + 2 Plates, Marseilles, 1918

The author (Professor at the French School of Paper-making) gives the results of tests they have made with 1) "*Passerina hirsuta* and other Thymelaeaceae, and 2) "bois-buchon" from French Guiana.

1) The test with *Passerina hirsuta* L. (= *Thymelaea hirsuta* Endl.) and with *Daphne* (of which the three biggest European species are *Daphne Laureola*, *D. Mezereum* and *D. Gnidium*, the others being much too small) do not fulfil the expectations regarding their utilisation for paper-making. Firstly, they are only small shrubs, which is already a disadvantage; secondly the bark, although relatively thick, yields too little, on account of the small dimensions of the stem, to be used alone; finally, the wood, which would have to be treated to increase the yield, is composed of such short fibres that it is worthless. These plants cannot be used for paper-making.

2) The "bois-buchon" (for which the author cannot give a botanical determination) is a wood remarkable for its lightness (d 0.60); it has very little colour, being almost white, from which standpoint it might do for paper-making, but it is far from tender on account of its high lignin content and is fairly difficult to cut.

This wood is unsuitable for paper-making; it contains too much lignin, it is difficult to treat and gives a poor yield, while the product obtained is very mediocre. At the most it might be utilised as a filling paste of no great value.

370 - Sphagnum as a Surgical Dressing.—Horson, J. W., in *Science*, N. S. Vol. XLVIII, No. 1235, pp. 203-208, Lancaster, August 30, 1928.

The use of sphagnum as a surgical dressing has become more and more common, not only for economic reasons but also because of the shortage of absorbent cotton. Of the numerous species of sphagnum, only four—*Sphagnum imbricatum*, *S. palustre*, *S. papillosum* and *S. magillanicum* are used for this purpose. These species should be carefully identified as they may easily be confused with others.

The value of sphagnum as a surgical dressing lies in its absorbency. The four above-mentioned species will absorb and hold 14 to 20 times their weight of water, whereas ordinary absorbent cotton will only hold 4 to 5 times its weight.

The sphagnum is simply gathered from the bog, freed from foreign matter, dried and sterilised. Experiments are in progress with a view to improving the dressings made and also to utilising the sphagnum for other purposes.

**INDUSTRIES
DEPENDENT
ON ANIMAL
PRODUCTS**

371 - Factors and Methods in the Profitable Production of Sanitary Milk (1). — NICHOLLS, W. D., in the *Kentucky Agricultural Experiment Station, Bulletin* No. 206, 44 pp. + 28 Figs. Lexington, Ky., March, 1917.

The bulletin under review is divided into two parts. The first deals with bacterial contamination and other factors influencing the hygienic production of milk and the practical means of limiting or controlling them: — health and cleanliness of the cows, hygienic, easily cleaned byres healthy and clean milkers, clean and hygienic vessels, clean, healthy fodder, abundant supply of pure water, cleanliness during milking, rapid cooling of the milk and hygienic, suitably situated dairies. As a model is given the plan of the byre at the Kentucky Agricultural Station.

The second part describes the author's experiments, made to determine the number of bacteria by which milk may be contaminated in the different daily processes in the byre and the dairy, and to find the best means of preventing bacterial contamination. To this end petri dishes containing sterile medium were placed in the byre of the Agricultural Station and in the adjacent dairy.

The results show that the air of a clean byre contains relatively few bacteria, but that their number increases greatly when dust forms and when the cows are in the byre. Litter increases considerably the number of bacteria in the air of the byre, ground foods and dirty hay are efficacious and lasting sources of contamination. Brushing the cows adds swarms of bacteria to the air. Washing the cows' udders, even though they appear clean, greatly decreases (by at least $\frac{1}{7}$) the number of bacteria which fall from them. In thick-grassed pasture land the atmosphere is almost free from bacteria. In a byre with smooth walls and concrete floor, washed carefully and regularly the air should be practically free from bacteria.

(1) For other works on the same subject see:—R. Aug.-Oct. 1911, No. 2779; Feb. and March, 1914, Nos. 152 and 259; Nov., 1915, No. 1207; Oct., 1916, No. 1098; May 1917, Nos. 483 and 485; Jan. and Sept. 1918, Nos. 71 and 1044. (*Ed.*)

CONCLUSIONS: To keep the bacterial content of the air of byres in which cows are milked low, the byres must be kept very clean, dust and dust-forming litter avoided, and the dust well laid by watering. As the hair of cows is laden with bacteria, all loose hairs must be removed from the cows by currying so that they shall not fall into the milk. Between this operation and milking sufficient time should elapse for the bacteria and dust to settle on the floor. The cows' udders must be carefully washed with warm water and a clean cloth before milking. Wiping the udders with a clean, wet cloth greatly decreases the bacterial contamination of milk. In distributing ground food and hay, care should be taken to raise as little dust as possible.

Experiments made at the Agricultural Station of Geneva, New York State, showed that the greatest improvements in the construction and keeping of the byres has but little influence on the bacterial contamination of milk and that the most efficacious means of preventing such contamination are:—removal of bits of skin, hair, and other foreign matter during milking, cleanliness during milking and the use of narrow-mouthed vessels; careful sterilisation of all instruments coming in contact with the milk, and protecting these instruments from contamination during the interval between sterilisation and their use.

372 - Composition of Buffalo Milk. — TARTLER G, in the *Zeitschrift für Fleisch und Milchhygiene*, Year XXVIII No 21, pp 327 329 + 2 Tables. Berlin, September, 1918

The author recommends the buffalo as a dairy animal because of the high food value of its milk and its resistance to tuberculosis which makes the milk particularly suitable for those suffering from this disease. The content of lactose, fat and albuminoid is higher in this milk than in cow's milk (1); the calcium and phosphoric acid content is also higher. This is seen by an analysis of buffalo milk made by the author:— Specific gravity 1.0333; moisture 81.94 %; dry matter 18.04 %; fat 9.07 %, total albuminoids 4.42 %; casein 3.54 %; albumin and globulin 0.51 %; lactose 5.19 %; ash 0.883 %. The ash contains:— Potassium 13.33 %; sodium 8.17 %; calcium 33.51 %; magnesium 3.75 %; chlorine 9.19 %; phosphoric acid 33.59 %.

Buffalo meat is richer in iron than steer's meat and is, therefore, excellent for convalescents.

373 - Cooperative Creameries and Cheese Factories in Minnesota, U. S. A., 1914. — DURAND, E. D., and ROBOLEK, F., in *The University of Minnesota Agricultural Experiment Station, Bulletin* 166, 53 pp + 7 Figs. St. Paul, March, 1917.

This bulletin gives a statistical study of the cooperative cheese and butter factories in Minnesota, laying particular stress on the importance of cooperative and private establishments respectively. In 1914 there were in this State 850 butter factories, 622 of which were cooperative. Of the non-cooperative butter factories 39 were creamery centres and 189 private concerns dealing with local production. Of 120 806 398 lb. of butter

(1) See B. Aug. 1912, No 911 (Ed)

produced during that year, 61.4 % was from cooperative dairies, 25.6 from creamery centres, and 13 % from private dairies. More than $\frac{1}{5}$ of the total milk fat received by the cooperative dairies came from whole milk and gave the best butter.

The cooperative butter factories pay their proprietors 89.7 % of the cash profits, private factories 87.9 %, and creamery centres 87 %. The cost of producing 1 lb. of butter and the price paid for milk fat were slightly higher in the co-operative butter factories than in the others.

In Minnesota the cheese industry is concentrated in a few, small districts. More than half the production is supplied by Goodhue County. Of the 71 cheese factories existing in 1914, 36 were cooperative, 31 private, and 5 connected with the central dairies. The cooperative factories were limited to the manufacture of Cheddar. Brick cheeses, and those of the Swiss type were only made by private factories. About $\frac{3}{4}$ of the total cheese and $\frac{4}{5}$ of the Cheddar made in Minnesota came from cooperative factories. If comparison be limited to the factories producing Cheddar it is found that the cooperative cheese factories distributed to their shareholders about 2 % more of the cash profits; as compared with private factories they paid 8 cents per 100 lb. more for their milk and sold their cheese at 9 cents a lb. more.

The influence of the cooperative movement on the dairy industry in Minnesota is then discussed. According to the United States' census of 1910, cheese-making decreased in Minnesota from 1890 to 1910 the production of this last year being barely 27 % of that of 20 years previous. Nevertheless it progressed subsequently; from 1910 to 1914 the production increased by 24 %. The production of butter has increased continuously since 1880. During the ten years ending 1916 it almost doubled. Today Minnesota holds third place among the butter-producing States of the United States; Iowa is very little in advance and may be overtaken by Minnesota. The quality is excellent. One of the most powerful factors of this progress is without doubt cooperation.

Details are given of the organisation of a cooperative butter factory. In the appendix are given the laws of Minnesota dealing with cooperation and the articles employed in the organisation of cooperative butter factories.

374 - The Food Value of Argentine "Tasajo", — *Anales de la Sociedad Rural Argentina*, Year LIII, Vol. LII, pp 238-240. Buenos Ayres, April, 1918.

This study, presented by M. LAVENIR to the Minister of Agriculture of the Argentine Republic, gives the following analysis of two samples of "tasajo" (salted, sun-dried meat) (1) prepared in the Argentine, together with the analysis of a sample of fresh meat for the purpose of comparison;

(1) As regards the way "tasajo" is prepared and the importance of this industry in the Argentine, see *R*, April, 1913, No. 415 (*Ed*)

	Dry meat			Fresh meat
	Sample No. 1	Sample No. 2	Average	
Water (at 105°C).	36.52 %	23.28 %	29.91 %	72.15 %
Total mineral matter	16.62	14.99	15.80	1.99
Organic matter.	46.84	61.73	54.28	26.86
Total nitrogen	7.45	8.57	8.01	3.30
Nitrogen matter (N X 6.25).	46.44	53.66	50.06	20.62
Fat	0.32	7.66	3.90	5.85
Sodium chloride	15.85	13.55	14.70	0.08

Both for the quantity of nitrogenous matter as for that of organic matter, 1 kg. of 'tasajo' is equal to 2.5 kg. of fresh meat, assuming the digestibility to be the same. M. LAVENIR has found that the water solubility of the organic matter is the same for both dried and fresh meat; the solvent action of pepsin is a little more energetic for fresh meat than for dried meat (treatment for 2 hours, at 37-38° C. gave: for fresh meat, 50 % of dissolved, and 50 % of undissolved, matter; for dried meat 43 and 57 % respectively for sample No. 1 and 40 and 60 % for sample No. II)

375 **The Meat Industry in Brazil.** - See No. 339 of this Review

376 - **Soudanese Wool.** - AMMAN, PAUL, in *L'Economiste Colonial*, Bulletin mensuel du Jardin Colonial, New Series, Year No. II pp. 69-71 PARIS, November-December 1918.

The many flocks of sheep that are to be met with in the Soudan, "woolly" sheep and "hairy" sheep, and sheep produced by crossing the two breeds, yield wools of extremely variable quality. Some are fairly fine, others more or less coarse, while others contain varying proportions of hairs. It is not exceptional to find these different wools mixed together in bales of commercial wool, which explains why Soudanese wool is badly received in France.

All the different types of Soudanese wool or hair can be utilized industrially. But the wool must certainly be sorted before shipping it, by setting apart the fine wool, the slightly coarser wool, the long, hard, shining wool and the coarse wool. The hairs should be excluded completely as they should form a separate category and be classed by their length. In this way goods of uniform quality are obtained, answering to well-defined types, and which the buyer can take with confidence.

377 - **The Agricultural Source of Benzoic Acid.** - MALONY, P. J. and SHUTT, F. T., in *The Agricultural Gazette of Canada*, Vol. V, No. 12, pp. 1130-1132. Ottawa, December 1918.

As the present price of benzoic acid is 5 to 6 times the pre-war price the authors attempted to utilise an economic source of this acid - the urine of herbivora - and to modify the extraction process so that it may be adopted by farms without any special installation.

The hydrolytic decomposition of the hippuric acid of the urine of herbi-

vora gives glycochol and benzoic acid. To extract this acid the urine is treated with milk of lime, the solution filtered, the filtrate concentrated by evaporation and the benzoic acid precipitated with hydrochloric acid. By a second method the decomposed urine mixed with milk of lime is treated with carbonic gas which removes the excess of lime, ferric chloride is added, the solution filtered and the insoluble ferric benzoate on the filter decomposed by hydrochloric acid. There is a third method, by which the fresh urine is evaporated to $\frac{1}{3}$ its volume, filtered, acidified with hydrochloric acid and left to cool; the hippuric acid crystallises and, by boiling with concentrated hydrochloric acid or caustic soda, hydrolyses into glycochol and benzoic acid. All of these methods are difficult to adopt on a farm.

There is, however, a simple method, based on the variation of the solubility of benzoic acid with the temperature. Thus, 100 gm. of solution contain 0.170 gm. of benzoic acid at 0°C , on 200 gm. at 10° , 0.289 at 20° , and 0.343 gm. at 25° . It is seen, therefore, that by cooling a benzoic acid solution to 0°C . a quantity of benzoic acid separates equal to that obtained by evaporating the solution to half its volume and bringing it to 25°C . By estimating the quantity of urine excreted daily by a cow to be 20 lb. per 1000 lb. live weight, the daily production of benzoic acid by cows would be 1 lb. It would thus be possible to collect each day by the above method 1 lb. of benzoic acid per 15 cows. This economical method could be adopted during the winter, when the urine may be easily collected in the byres, and would form a good supplementary source of income in the dairy industry.

AGRICULTURAL
PRODUCTS;
PRESERVING,
PACKING,
TRANSPORT,
TRADE

378 - Preservation of Beans and Peas. - HENYARD, J. W., in the *Jersey Agricultural Experiment Station, Circular* 51, 4 pp. New Brunswick, August 6, 1917

This circular describes the methods of harvesting, drying, threshing, and cleaning peas and beans, storage conditions, means of controlling weevils (carbon bisulphide is said to be the best), tests of the germinating capacity of the seed. Directions for the home drying of these vegetables are also given.

379 - The Cold Storage Industry and the Future of Italian Agriculture (1). - LERRETTI, U., in the *Rivista del Freddo*, Vol. IV, No. 19, pp. 271-286. Rome, October 1918

The industrialisation of agriculture, in the sense of a systematised production, rests on two fundamental bases: - 1) preservation of the products; 2) their arrival at the market, in the best possible condition of

(1) The *Statistical Yearbook of the Kingdom of Italy* for 1916 shows that, up to December 31, 1916, there were, in Italy, 212 cold storage establishments for preserving food products of animal origin, including machinery capable of developing 4 million "frigorio-heures" (i. e., the number of calories removed in cooling a body for one hour); there were 490 ice-factories capable of producing 32,000 quintals every 24 hours; there were 70 breweries provided with condensing machines which could develop 10 million "frigorio-heures"; and there were 150 firms of various kinds that used cold-storage and could develop 3 million "frigorio-heures".

The "Decreto Luogotenenziale" (Decree of the Viceroy) No. 1747, of November 21, 1918 (*Gazzetta Ufficiale* No. 283, December 2, 1918) laid down a series of measures for encouraging the construction and use of cold storage machinery for preserving food products, these measures

freshness This problem specially affects the Italian agriculturist when he sells his products in foreign markets, where Italian goods are much depreciated and even considered often as a nuisance, owing to the competition of countries where preservation by artificial cold has been in use and continually improved for something like 20 years. Thus Californian products arrive at Genoa, thanks to cold storage while Sardinia, though near by and with products certainly not inferior to the former ones, sells them there at fancy prices or they deteriorate on the spot, owing to the lack of cold storage and means for transport at low temperatures.

For crops grown on a large scale, such as cereals and vegetables, cold also helps to preserve the seeds (especially if they are to be used for sowing) by protecting them from parasites and conferring on them a greater yielding capacity, estimated to be at least 70 %, according to the results obtained by the Agricultural Stations in the United States. In addition, the preservation of seed by cold, while being more efficient than that based on the use of chemicals is also cheaper. Cold storage can be used with the greatest possibility of success in all the stages of wine making, from the vintage to sale. But cold storage is especially needed in the case of crops grown on a large scale, and whose products go bad rapidly, such as potatoes (average production in Italy 17-18 million quintals, area growing them 280 000 to 290 000 hectares), chestnuts (average production, 8-9 million quintals) milk and garden products (average production, 11-12 million quintals) area growing them, 70 000 to 72 000 hectares), various fruits (average production, 9-10 million quintals) species of *Citrus* (average production, 8-9 million quintals, area growing them, about 70 000 hectares), 25 to 30 % of the Italian potato crop is lost every year, either owing to sprouting or rotting. Chestnuts from Cuneo, which are greatly sought after on the North American market, have to be sent to Havre to be shipped by French boats provided with cold storage, as no boats sail from Genoa equipped in this way. The use of express trains for carrying the first flowers, vegetables and fruits of the season is only a palliative, for the product has to be sold immediately on arrival at its destination just the same, while refrigerated goods, which will keep longer, can be stored until the conditions of sale are more favourable.

Before the war (1913), Italy exported perishable goods to the value

were - 1. Education - public utility exemption for 1 year from the land tax with in the tax with the "rich zemle" (for the part of the revenue tax exempted of the capital engaged) special concession for transport etc. In quoting this decree (*Kritika* 11 Nov. pp. 325-330 Rom. Nov. 13, 1918) Prof. LUKATSKY foretells the great benefit might be to Surinam which produces great quantities of all kinds of food stuffs - and shows the need for efficient means of storing, refrigeration and inland transportation. He also states that the Delegazione centrale Imprese (Central Fisheries Delegation) has already adopted the following measures - pumps whaler fitted with cold storage at the disposal of private persons to collect the catch and Surinam to carry it. Italy the use of thermocans for land transport at low temperature (*I* 1).

of 288 million francs, 60 % of which went to Germany and Austria, as is shown in the appended table.

Products	Quantities exported	Value of total exportation	Value of direct exportation to Germany and Austria
	in thousands of quintals	in millions of francs	in millions of francs
Potatoes	1 500	20	12 (Germ.)
Chestnuts	35-40	10	3 (Aust.)
Fresh vegetables	1 000	22	13-14
Tomatoes	200	2	0.5
Oranges	1 500	35	25
Lemons	3 000	60	18
Table grapes	300	11	9 (Germ.)
Apples and Pears	1 500	35	24-25 (Germ.) 4 (Aust.)
Peaches	70	3.5	3
Cherries	150	4.5	2
Other fruits	270-280	10	7.5
Shelled almonds	130-140	40	27
Nuts	150-160	15	5 (Germ.)
Dried figs	250	9	6 (Aust.)
Other plants products	700	11	6.5

In cold storage French beans require a temperature of about $+2^{\circ}\text{C}$., and a hygrometric degree of 80 %, while artichokes, which will keep 3 months, need a temperature slightly higher than 0°C . and sufficient humidity; tomatoes and egg-plant fruit should be gathered almost ripe, wrapped in tissue paper, placed one row deep in trays and stored at about 2°C . with a high degree of moisture. Asparagus should be kept at about 0°C . and covered with damp cloths; cabbages and cauliflowers, which will keep 4 months, at 0°C ., potatoes (which will keep 7-8 months) at 2.4°C ., and with a degree of moisture of 60-70 %; onions (keeping 6-8 months) at $1-2^{\circ}\text{C}$.; strawberries (will keep a few weeks) at from -1 to $+2^{\circ}\text{C}$., with a hygrometric degree of 100 %. In refrigerating fruit, all those that are not perfectly sound should be picked out, good ventilation should be provided, together with a suitable way of packing; from 0 — 2°C . should be used for pears, apples, plums and apricots, about 0°C . for peaches and cherries, below 0°C . for grapes, and from $1-2^{\circ}\text{C}$. for oranges, etc.

380 - Cold Storage and the Italian Fishing Industry. - *Rivista del Commercio*, Year IV, No. 10, pp. 265-269 Rome, October 31, 1918

At the first National Congress of Italian Fishing held at Ancona on September 7 to 8, 1918, Prof. UBERTO FERRETTI dealt with the application of artificial cold to the fishing industry. In Italy, there is a tendency to replace sails by steam or other kinds of motive power; but at the

same time the means for preserving and transporting the fish must be prepared, using cold storage as a basis: cold-stores in the hold; cold stores in fishing centres; cold-storage vans for transport to the centres of consumption; cold-stores in the markets.

In the order of the day given as a corollary to his paper, Prof. FERRETTI moved that 1) the cold-storage transport of fishing products whether by water or by rail should be provided with everything to ensure the good preservation of these products, 2) the creation of cold-stores in the ports and in fish markets should be favoured and carried out as opportunities permit, 3) the most complete instructions and most efficacious means should be provided to develop the fitting out of State steam boats and merchant vessels with refrigerating chambers

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- 381 **Blackheart and the Aeration of Potatoes in Storage.** — SEEWART, F. C. and MITCHELL, A. J. in the *New York Agricultural Experiment Station, Bulletin No 436*, pp. 321-362, 10 Plates. (GIVEN) N. Y., June, 1917.

The present knowledge of blackheart of potatoes is based on BARTHOLOMEW's investigations. BARTHOLOMEW showed that blackheart may be brought about by exposing the tubers to a temperature of 38-45°C during 14-48 hours, and that it is caused by injury to the tissues through respiration trouble. The chance discovery that, by depriving potatoes of air, blackheart may occur at much lower temperatures than those used by BARTHOLOMEW lead the authors to make a thorough study in order to determine the connection between aeration and blackheart as well as the effect of storing potatoes in high heaps in cellars and lofts, and in pits or unventilated heaps in the open. Most of the experiments were made with sound potatoes, washed, wiped and placed in 3500 to 3700 cc. capacity jars fitted with ground-glass stoppers. To study the effect of storing potatoes in high piles galvanised iron cylinders 9 inches in diameter and 80 to 126 inches high were used. The top was left open, but the bottom and sides were air-tight. One experiment was made in the open with piles of potatoes protected against frost by a cover of oat straw and earth. The temperature varied from 2 to 24°C. The experiments were made in April and May 1914, from January to May, 1915, and from October, 1915 to May 1916. The Sir Walter Raleigh variety was used in all the experiments.

The observations are reported in detail. The conclusions drawn are as follows:—

Potatoes cannot withstand being kept long in closed surroundings. After a certain lapse of time which varied with the temperature and amount of air available, the tubers in the hermetically sealed jars became wet over part of, or all, their surface and when subsequently exposed to the air the wet parts turned brown and the flesh turned first pink, then black. With a volume of air equal to that of the potatoes, 10 to 12 days sufficed to produce these symptoms when the temperature was about 20°C.; at a temperature of 13 to 15°C. about 20 days were necessary, and at a temperature of 4.5°C. 23 to 40. Tubers in jars half or a quarter full behaved similarly to those in full jars, except that the symptoms appeared later. Potatoes in sealed jars with less than 10 times their volume of air could only start germination; for normal germination a volume of air 19 times that of

the potatoes was necessary. Blackheart may be expected whenever the volume of available air is less than that required for normal germination.

Tubers of equal size differed greatly in their aptitude to contract both blackheart and discoloured surface. The cause of this has not been determined, but it is doubtful whether the size of the tuber is an important factor.

The results of the experiments with potatoes in deep bins to determine the height to which they may be safely heaped, are considered by the authors to be insufficient to formulate precise rules, but 6 feet may be considered the maximum height at which potatoes may be heaped for storage during several months at a temperature below 7°C, whereas at temperatures above 10°C the piles should not be higher than 3 feet, if the potatoes are to be kept for more than 3 or 4 weeks. Tubers which suffered from insufficient aeration as a result of the excessive height of the heap behaved as a rule like those in sealed jars. They germinated little or not at all, their surface was wet, the exterior was discoloured through exposure to the air, and they frequently developed blackheart. The principal difference lay in the presence of patches of rot caused by fungi and bacteria.

Blackheart was sometimes found in potatoes piled in the open and was due to insufficient aeration, although the experiments showed that the aeration of potatoes in heaps without special arrangements for ventilation is better than would be expected, and that ventilation is not necessary for small heaps. Deterioration caused by insufficient aeration was due rather to lack of oxygen rather than an accumulation of carbon dioxide.

Potatoes attacked by blackheart as a result of exposure to a high temperature were generally normal outside, whereas those in which blackheart was due to lack of air were usually more or less discoloured on the surface.

Insufficient aeration during storage does not cause spindling-sprout. It may delay germination temporarily, but, if later the potatoes receive sufficient air they either do not germinate at all, or else their shoots are normal. Tubers badly attacked by blackheart are not fit for use as seed, but those only slightly attacked may be so used. If the tubers appear sound and normal it is unlikely that the storage conditions have caused them to deteriorate for seed purposes.

Blackheart is not only a question of storing, it is also a question of transport. It often occurs as a result of over-heating during transport in heated waggons.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

362 - The Influence of Parasitism on Leaf Transpiration — See No 299 of this Review.

GENERAL

383 - Biological and Systematic Observations on *Gymnosporangium clavariæforme* and *G. tremelloides*, in Sweden. — ERIKSSON, J., in the *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, First Half Year, 1919, Vol. CLXVIII, No. 9, pp 476-473 Paris, 1919

In Sweden two species of *Gymnosporangium*, *G. clavariæforme* (Jacq.)

D. C. and *G. tremelloides* (A. Br.) v. Treb., occur on *Juniperus communis*.

Gymn. clavariaeforme grows on the common juniper. The fungus appears about the middle of May on the eldest branches that show diseased swellings.

The peripheral parts of the cylindrical, tongue-shaped masses that arise out of the bark are formed entirely of thick-walled, dark brown spores; the two cells that constitute the spores are separated by a broad median septum. The central portions of the gelatinous masses are, however, formed by thin-walled, pale brown spores whose cells are, incompletely joined by a narrow wall.

When the thick-walled spores germinate, each of the two cells that make up the spore give rise to a short promycelium which gives off lateral sporidia. When the thin-walled spores germinate, however, the two cells separate more or less completely; usually each of them gives off a long germination filament that produces conidia by budding at the tip.

The aecidium of the Swedish form of the fungus (*Roestelia lacerata* [Sow.] Fr.) develops on the leaves just as well as on the branches and flowers of *Crataegus monogyna* and *C. nigra* (hawthorn). Occasionally, the aecidial form of this species also occurs on *Cydonia vulgaris* (quince); exceptionally, it produces spermogonia on *Pyrus Malus* and *P. communis*.

According to the country that produces *Gymn. clavariaeforme* this fungus gives rise to three forms that differ in their biological characters, but which, in the teleutospore stage, are equal from the morphological point of view. For this reason they cannot be characterised as different species, but rather as specialised forms of the same collective species. These are given below:—

1) f. sp. *Crataegi*, with aecidium on *Crataegus coccinea*, *C. Doublasii*, *C. grandiflora*, *C. monogyna*, *C. nigra*, *C. Oxycantha*, *C. punctata*, *C. sanguinea*, *C. tanacetifolia*, and *C. tomentosa*; rarely the fungus has its aecidial form on *Cydonia vulgaris* (Austria, Sweden) and *Pyrus communis* (Austria, England, Germany, Switzerland), as well as on *Amelanchier canadensis* (service berry) *A. erecta* (N. America) and *A. vulgaris* (Germany); 2) f. sp. *Pyrus-communis*, with aecidium on *Pyrus communis*, this form occurs in Austria, England, Germany and Switzerland, as an exception, *Crataegus* spp., *Cydonia vulgaris* (Austria) and *Amelanchier vulgaris* (Germany) may be infected; 3) f. sp. *Amelanchieris*, with aecidium on *Amelanchier alnifolia*, *A. canadensis*, *A. erecta*, *A. intermedia*, *A. oblongifolia*, *A. aerophila*, *A. polycarpa*, *A. pumila* and *A. vulgaris*.

Gymn. tremelloides (= *Gymn. Juniperi* Lk., *Gymn. tremelloides* R. Hart) occurs in the neighbourhood of Stockholm, where it appears about the end of May. In this district it is commoner than the preceding species and lives on the common juniper. On this tree it either forms on the branches large, chocolate-coloured tumours which are laid bare by the rupture of the epidermis, or it develops small compact cushions, also dark brown in colour, on the needles. After rain, the latter, like the tumours on the branches, swell up and take on a yellow colour.

The gelatinous masses of this species are also formed of peripheral

spores t. at are thick-walled and dark brown, and central spores that are thin-walled and pale brown. The two compartments of the thick-walled spores are firmly joined by a broad septum, while those of the thin-walled spores are weakly joined by a narrow septum, so that the latter spores are easily disseminated. In the tumours on the branches, the thick-walled spores taper off symmetrically at each end. In the little 'cushions' on the needles, on the contrary, the same spores lengthen out irregularly towards both ends, and it often happens that the corners by the median septum, are elongated laterally. Contrary to the assertion of P. DIETEL and others, there is no specific difference between the tumours of the branches and the cushions on the needles.

The thick-walled cells germinate by producing short promycelia which develop lateral sporidia. The thin-walled cells, on the contrary, usually germinate by giving out long germinative filaments which produce conidia by budding at the tip.

The sporidia germinate by giving out a lateral, thin, germinative filament; the conidia produce a thicker filament at their tips.

In different countries *Gymn. tremelloides* presents different biological characters. As far as is known, the fungus shows no morphological differences in the teleutospore stage. This is why the author qualifies them as specialised forms of the same collective species; these are as follows: — 1) f. sp. *Aucupariae* (= *Gymn. Juniperi* Lk., etc.), with aecidium (*Roestelia cornuta* [Pers.] Müll) on *Sorbus Aucuparia*; this form is known in Denmark, Germany, Switzerland and Sweden, in Sweden spermogonia have often been produced experimentally on *Cydonia vulgaris*, more rarely on *Sorbus Aria* and exceptionally on *Pyrus Malus*; 2) f. sp. *Mali* (= *Gymn. tremelloides* R. Hart., etc.; *Gymn. Mali-tremelloides* Kleb.) with aecidium (*Roestelia penicellata* [Müll] Fr.) on *Pyrus Malus*; this form occurs in Denmark, Russia and Sweden, spermogonia have often been obtained experimentally in Sweden on *Cydonia vulgaris*, more rarely on *Pyrus communis*, and exceptionally on *Sorbus Aucuparia*; 3) f. sp. *Amelanchieris* (= *Gymn. Amelanchieris* Fisch.), with aecidium (*Roestelia Amelanchieris* [D. C.] Roum.) on *Amelanchier vulgaris*, this form is recorded from Germany and Switzerland; 4) f. sp. *terminalis* (= *Gymn. terminalis-juniperinum* Fisch.), with aecidium on *Sorbus terminalis* and *S. latifolia*; this form has been found in Switzerland; sometimes, it appears, it can attack *Sorbus Aria*, *S. Chamaemespilus* and *S. hybrida* and, perhaps, others; 5) f. sp. *Ariae* (= *Gymn. Ariae-tremelloides* Kleb.), with aecidium on *Sorbus Aria*; this form is recorded from Germany and Switzerland; the aecidial form is sometimes found on *S. Chamaemespilus* also.

The fact that it is rarely found in the neighbourhood of Stockholm, the teleutospore form of the fungus attacking the apple, the great distance from the juniper (300-1500 metres), as well as the feebleness of the attack of this form, do not agree very closely with the abundance of *Roestelia penicellata* on apples in the same region. Is there then, it may be asked, an internal source of disease, a stage in the evolution of the fungus, living

vegetatively during the winter in the apple buds, from which the summer outbreak of the disease might be derived?

In the southern part of Sweden, a form of *Roestelia* has sometimes been found on the pear, which might have to be attached to *Gymn. clavariforme* f. sp. *Pyrus-communis*.

RESISTANT PLANTS

- 384 - **Wheats Resistant to Adverse Weather Conditions and to Rust, in France.** — See No. 278 of this Review

- 385 - **The "Early Rose" Potato Resistant to Mildew (*Phytophthora infestans*), in Poland.** — See No. 306 of this Review

- 386 - ***Coffea congestis*, Resistant to *Hemileia vastatrix* in Madagascar.** — See No. 24 of this Review

MEANS OF PREVENTION AND CONTROL

- 387 - **Lime Sulphur Mixture for the Control of Wheat and Barley Smut.** — MACKIE, W. W., in *Science*, N. S. Vol. XI, VIII, No. 1247, pp. 515-516, Lancaster, Pa., November 22, 1918

The control of stinking smut of wheat along the Pacific coast seems to depend largely on the prevention of re-infection of the treated grain by spores of the agent of the disease in the soil or on its surface. Even when a field is free from smut the soil may be infected by neighbouring fields or by threshing, when numbers of smut spores are scattered in the air and carried for miles by the wind. Treatment with formaldehyde, so efficacious and economical in States east of the Rocky Mountains, where infection of the soil does not appear to exist, is useless when the soil is infected. This is due to the immediate evaporation of the formaldehyde when the solution dries on the grain.

On the Pacific coast wheat growers usually agree that grain treated with copper sulphate is almost or entirely free from infection from the soil. As the copper sulphate solutions used are very strong (1 lb. to 4-5 galls. of water) they injure considerably the germination of the wheat; to prevent this loss the caryopses treated with copper sulphate are washed in a lime solution. This double treatment greatly increases the cost of labour and farmers frequently ask whether the lime could not be mixed with the sulphate so as to have but one operation. Since lime counteracts the effects of the copper sulphate on the smut spores this method is not advisable.

To solve this question the author made experiments with lime-sulphur mixture. The preliminary experiments on wheat and barley showed the mixture, even in fairly dilute solutions, to be very efficacious against stinking smut of wheat and covered smut of barley. A thick coating of the mixture adheres to the grain, thus protecting it very well against infection from the soil. Even when a very strong mixture (1 part of mixture to 1 part of water) is used the preliminary experiments have shown no injurious effect on the germination of wheat or barley.

388 - Patents for the Control of Diseases and Pests of Plants — See No. 362 of this *Review*

389 - Diseases and Pests of the "Guayule" (*Parthenium argentatum*). — See No. 320 of this *Review*.

390 - *Pestalozzia Guepinii* on the Tea Plant in the Caucasus. — See No. 323 of this *Review*

391 - Disease of the Cacao Plant in Madagascar. — See No. 321 of this *Review*

392 - Observations on *Peronospora Spinaciae*, injurious to Spinach in Sweden. — ERIKSSON J., in the *Arkiv för Botanik*, Vol. XV, No. 15, 25 pp. + 3 Figs. + 4 Plates. Stockholm, 1918

In Sweden as in many other European countries and in North America, the leaves of spinach are attacked by a *Peronospora* which, differing from the majority of previous authors, the author prefers to consider, as does LAUBERT, as a distinct species under the name of *Peronospora Spinaciae* (Grev.) Laub.

This fungus has been observed in various localities in Sweden at any rate since 1904. *Per. Spinaciae* has appeared near Stockholm almost annually and with varying intensity during the period 1904-1913. In the middle of July, 1911, it attacked a bed very violently, all the spinach being infested by the fungus in a few days. Another bed behaved quite differently; in this bed, about 100 feet away from the first and in which the spinach had been planted at the same time as in the previous one, the plants were, on the contrary, quite free from the parasite. There were no shrubs in the locality that could have hindered the spread of the spores of the fungus. The only difference was that the seeds used for the two beds had been bought from different seedsmen. The unattacked bed remained free all summer and autumn. The different behaviour of the plants in the two beds can only be explained, according to the author, by the introduction of the disease with the seed into the infected bed. To check the truth of this theory, the author gathered the seeds from the healthy bed in autumn; this seed, when sown in different beds, gave nothing but healthy plants in the following year.

The author describes the life cycle of the fungus, according to the results obtained by him in cytological researches begun in 1911.

According to these researches the life cycle of *Peronospora Spinaciae* appears to be established from its first appearance when it appears as a fungoid system of colloidal nature, enclosing filamentous and granular formations living in symbiosis with the protoplasm of the host cell, then destroying the chlorophyll grains up to the extrusion of the primary filaments of mycelium through the stomata. It still remains to be found how the fungus in the form of plasma, perhaps with the aid of spores of secondary formation, penetrates into the host plant.

To make sure of having a crop of spinach free from the fungus, only seed should be used that is known to have been gathered from healthy plants.

- 393 - **Further Researches on Bramble-Leaf Disease of the Vine** (1). — PETRI, L., in the *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, Vol XXVII (2nd. Half-Year, 1918), Pt 9-10, pp. 271-275 + 1 Fig. Rome, 1918.

The results of recent experiments carried out by the author at the Royal Nursery at Arizzano (province of Novara), at the Higher Forestry Institute at Florence, and in Sicily, especially on the variety "Rupestris du Lot", confirm previous affirmations, i. e., that the specific cause of bramble-leaf disease (French: "roncet", "court-noué") of the vine is to be found in the soil; in addition, it is shown that the pathogenic action is due to a microorganism which has the morphological characters of a plasmodium. This microorganism, after living a certain time in the free state in the soil, penetrates the tip of the roots, and spreads in them, causing a stoppage of growth in length and deformation of their tips.

The attempts to isolate the microorganism in question suggest that it may possibly be cultivated on artificial nutritive media.

- 394 - **Harziella Castaneæ, a Hymenomycete Causing Black-Rot of Chestnuts** (2). — MANGIN L., in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol IV, No 32, pp 885-889. Paris, 1918.

Researches carried out by the author with the help of M. VINCENS have shown that black rot (French: "pourriture noire") of chestnuts is produced exclusively by *Harziella Castaneæ* which confirms BAINIER'S opinion and that the rot does not develop on fruit attached to the tree, the infection taking place after the chestnuts have fallen to the ground.

While the fungus is growing, a very active evaporation takes place which makes the edible part very light. This property is well known to growers, who utilise it for separating diseased from healthy fruit by putting them in water, when the diseased ones float and the healthy ones sink to the bottom. But this process is deceptive as fruit that are at the beginning of an attack of rot are still heavy enough to fall to the bottom, left with healthy chestnuts, they finally cause the whole crop to rot.

To protect the chestnuts against the attacks of *H. Castaneæ*, the author recommends the use of sulphur dioxide by proceeding as follows: — gather the fruit each day and dry them in the sun on a clean spot or on racks; dry green leaves in the sun; then place a layer of leaves in the bottom of a small cask or box, cover it with a layer of chestnuts, cover them with another layer of leaves and another of chestnuts and so on, until the box is half-full; burn one or two sulphur "matches" and close the cask or box very tightly; after 48 hours, open the box and fill it with green leaves and chestnuts that have already been treated; close it up and store it away in a place sheltered from cold and damp.

If it is feared that the chestnuts are already much attacked by black rot, separate them by difference of density; those that sink to the bottom

1) See R., July 1914, No 684; R., Sept 1916, No 1029 (Ed.)

(2) See R., February, 1917, No 203 (Ed.)

(they are left in for 5 to 10 days, according to the method used in the canton of Mercoeur, Correza) are dried in the sun, then treated in the way described above.

WEEDS AND PARASITIC FLOWERING PLANTS

395 - **The Growth of Weeds Favoured by Weather Conditions, in the Rice fields of Piedmont, Italy.** — See No 279 of this Review

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

GENERAL

396 **Italian Coccidae.** — LEONARDI, G., in the *Bollettino del Laboratorio di Zoologia generale e a varia della R. Scuola superiore di Agricoltura in Portici* Vol. XII pp 188 216 + 13 Figs. Portici (Naples) 1917 1918

The list of Italian coccidae has been increased, of late years, by various new forms. These are —

- 1) *Aspidiotus ludericola* Lind., on *Hedera Helix*,
- 2) *A. britannicus* Newst., on *H. Helix*, *Rhamnus Alaternus* and *Viburnum* sp.,
- 3) *A. lataniae* Sign., on *Pandanus Verticillatus*,
- 4) *A. lenticularis* Lind., on *Olea europaea*, *Pistacia Lentiscus*, *Populus tremula*
- 5) *A. ligusticus* n. sp., on the vine,
- 6) *Hemiberlesia subterranea* Lind., on *Agropyron intermedium*, *A. repens* and *Agropyron* sp.,
- 7) *H. ephedrarum* (Lind.), on *Ephedra nebrodensis*,
- 8) *H. trabutii* March. on the same host plant,
- 9) *H. canariensis* (Lind.), on *Centaurea* sp.,
- 10) *Targionia nigra* Sign., on *Cineraria maritima*,
- 11) *I. laapi* (Lind.), on *Genista pilosa*,
- 12) *Lepidosaphes tuberculata* Maken., on *Cymbodium Iracyanum*,
- 13) *Pseudoparlatoria parlatoriodis* Ckll., on an undetermined plant,
- 14) *Adiscodiaspis encicola* March. on *Erica arborea*,
- 15) *Howardia biclavis* (Comst.) on *Hacmatovylon campichianum*,
- 16) *Eulcanium prunastri* (Tonsc.), on wild plum and on peach,
- 17) *Eul. piligerum* n. sp., on plum,
- 18) *Eul. ficumum* Paoli on *Ficus Carica*,
- 19) *Eul. sericeum* Lind., on *Abies alba*
- 20) *Eucalymnatus tessellatus* (gn.), on *Kentia* and other palms, and on *Pterospermum acerifolium*,
- 21) *Pseudococcus diminutus* n. sp., on *Phormium tenax*,
- 22) *P. notabilis* n. sp., on *Myoporum tuberculatum* and *Nicotiana* sp.,
- 23) *Rhipersia silvestris* n. sp., in a nest of *Plagirolepis pygmaea* (Latr.),
- 24) *Iriococcus cactearum* n. sp., on *Cereus* sp. and *Mammillaria* sp.;
- 25) *Nidularia pulvinata* (Planch.), on *Quercus Ilex*

As an appendix a list of all the coccidae so far recorded in Italy and their respective host-plants is given. A total number of 147 coccidae is given in the list

397 - *Coccididae of the Philippine Islands* (1). — ROBINSON, E., in *The Philippine Journal of Science*, Section D, General Biology, Ethnology, and Anthropology, Vol. XIII, No. 4, pp. 145-147 + 3 Figs. Manila, 1918.

The list given includes the following species collected in different parts of Lucon island:

- 1) *Phenacoccus spinosus* n. sp. on *Ficus nota*,
- 2) *Pseudococcus virgatus* (Cockerell), on *Brideha stipularis* and *Hibiscus Rosa sinensis*,
- 3) *Hemichionaspis aspidistrae* (Signoret), on ripe fruit of *Areca Catechu*,
- 4) *Aspidiotus cydoniae* Conistock, on *Samanea Saman*,
- 5) *Pseudoanidia manilensis* n. sp., on the preceding host,
- 6) *Chrysomphalus rossi* (Maskell), on *Phalaenopsis* sp.,
- 7) *Greeniella javanensis* (Green), on *Eugenia* sp.
- 8) *Lepidosaphes glorii* (Packard), on ripe fruit of 4 *Catechu*.

The author also refers to *Cryptoparlatoria uberifera* Lindinger, said to have been collected in the Philippines on *Artocarpus* sp. and *Mallotus philippinensis*. He did not find this species.

398 - *Coccidae from the Island of S. Thomas* (2). — DI STABRA, A. F. and VAYSSIERE, P. in the *Bulletin de l'Institut de France*, N. 1, pp. 162-164. Paris, 1918.

The list includes —

- 1) *Icerya purchasi* Mask., on cultivated *Rosa*, coccid not yet recorded from western or equatorial Africa,
- 2) *Orthocaria insignis* Dougl., very common on leaves of *Coffea arabica*, especially attacks the terminal bud and seems to favour the development of *Capnodium coffeae*, it has not yet been recorded from the French colonies in Africa.
- 3) *Pseudococcus citri* (Risso), on roots and fruits of *Theobroma Cacao*,
- 4) *Ceroplastes* sp., fairly abundant on the branches of *C. arabica*;
- 5) *Vinsonia stellifera* Green, two specimens only on leaves of *Citrus* sp., the species had not been previously recorded in Africa.
- 6) *Lecanium nigrum* Nietn., fairly common on leaves of *Hevea guianensis*, but apparently not very injurious,
- 7) *L. viride* Green, very common on leaves of *Coffea liberica*, together with its parasite, *Cephalosporium Lecanii*,
- 8) *Aulacaspis pentagona* (Targ.), very abundant on *Carica Papaya* and on *Hevea guianensis*, not yet recorded from the west coast of Africa;
- 9) *Aspidiotus* (*Pseudoanidia*) *trilobitiformis* Green, very injurious to *Theobroma Cacao* in the island, from where the coccid had already been recorded but not from the French colonies in Africa,
- 10) *A. palmarum* Morg. and Ckll., common on leaves of *Carica Papaya* and *Artocarpus incisus*, rarer on leaves of *Theobroma Cacao*, *Persea gratissima* and *Citrus* spp.,

(1) S. C. A. Dec. 1917, No. 153. (Ed.)

(2) S. C. A. May 1918, No. 154. (Ed.)

11) *A. (Selenaspidus) articulatus* Morg., on *T. Cacao* and on various other representatives of the flora of the island;

12) *A. (Morganella) maskelli* Ckll., on *T. gratissima* accompanied by *Aulacapsis pentagona*;

13) *Mytilaspis becki* Newm. (= *M. citricola* Pack), on *Citrus* spp.;

14) *Ischnaspis filiformis* (Douglas), on leaves of *Coffea liberica*, but rare.

39) - New Host Plants of the Coccid *Lecanium persicae*, in France. — *Bulletin de la Société entomologique de France*, No 15 p 207 PARIS 1918

M. P. VAYSSIÈRE announces that the Entomological Station of Paris has received specimens of *Lecanium persicae* Fab., observed on *Euonymus japonicus* (at Bordeaux and Orleans) on *E. pulchellus* (1) (at Bordeaux), on *Ampelopsis* sp., and on *Wistaria chinensis*. Previously, these plants were not recorded as hosts of this *Lecanium*

400 - Bacterial Parasites of the Larvae of the Cabbage White Butterfly (*Pieris brassicae*) in France. — PAILLOT, A., in the *Comptes rendus des séances de l'Académie des Sciences* First Half Year 1911 Vol CLXVIII No 9 pp 476 478 PARIS 1919

From the larvae of *Pieris brassicae* five bacterial parasites have been isolated and named according to their respective cultural properties, *Bacillus pieris fluorescens*, *B. pieris liquefaciens*, *B. pieris non liquefaciens* α , *B. pieris non liquefaciens* β , and *B. pieris agilis*

The first four come from the region of Lyons (plateau of Sathonay) and the fifth was found at Schlières in the Jura mountains.

Amongst these bacteria, *B. pieris fluorescens* was found most frequently.

411 - New Bacterial Parasites of the Cockchafer, Observed in France. — PAILLOT, A., in the *Comptes rendus des séances de l'Académie des Sciences* Second Half Year, 1918 Vol CLXVII No 26, pp 1046 1048 PARIS 1918

Three species of bacteria that differ from those previously observed have been isolated from cockchafers from Tours. Two of them liquefy gelatine and can be placed in the group that the author calls *Lacillus melolonthae liquefaciens*, each species is designated by the letters β and γ , the third species, which does not liquefy gelatine, can be placed in the group *B. melolonthae non liquefaciens*, which already includes three other species (α , β , γ); it can therefore be designated by the letter δ .

The action of the new bacteria on sugar enables them to be distinguished from those previously included in the above mentioned groups.

412 - *Parexorisista caridei*, a Dipterous Parasite of the *Macrolepidopteron Oiceticus platensis*, injurious to Trees in the Argentine (2). — CARIDE MAS-SINT, P and BRÈTHES, J in the *Anales de la Sociedad Rural Argentina*, Vol LIII, Vol LII No 1 pp 207 215 + 11 Figs. + 1 Coloured Plate BUENOS AIRES 1918

Description of *Parexorisista caridei* Brèthes, parasitic on the larvae of *Oiceticus platensis* Berg ("bicho de cesto" or "bicho de canasto").

(1) According to the *Index Kewensis*, *E. pulchellus* is a synonym of *E. japonicus* Linn (Ed)

(2) See R, Feb 1912, No 459, R, Oct 1917, No 981, R, June, 1918, No 714 (Ed)

This appears to be the first dipteran recorded as a natural enemy of the macrolepidopteron. It has been introduced from the north of Cordoba into the province of Buenos-Ayres, where it has already bred. Only the future can tell whether, after becoming acclimatised in the new region, the dipteran will be as efficacious against *Oicetions platensis* as it is in the north of the Argentine.

403 - **An Insecticidal Powder from Corea.** - See No 325 of this Review

INSECTS, ETC.
INJURIOUS
TO VARIOUS
CROPS

404 - **On *Phthorimaea operculella* a Microlepidopteron Injurious to the Potato, and on its Presence in Morocco** (1). — *Bulletin de la Société entomologique de France*, N° 10 p. 270. Paris, 1918

Regarding the remark by M. J. DE JOANNIS on the presence and harmfulness of *Phthorimaea operculella* Zell. at Casablanca (western Morocco), M. F. PICKARD states that it is not the first time that this microlepidopteron has been observed in Morocco. He obtained it, in the early part of 1917, from the neighbourhood of Fez, where it does considerable damage. *Phthorimaea operculella* has been known for a long time in Algeria, and its presence in Morocco is probably not of recent origin.

405 ***Pectinophora gossypiella*, a Microlepidopteron Injurious to Cotton, in Italian Somaliland** (2). - DEL GUERCEO, in *L'agricoltura Coloniale*, Year XII, 2nd Ital. Vol. No. 5, pp. 298-311 + 15 Figs. Florence, 1918

Gelechia gossypiella (= *Pectinophora gossypiella*) is now even distributed through the cotton-growing regions of Italian Somaliland, where it has been reckoned that the cotton capsules are attacked by the insect nearly in the proportion of 100 %.

The author has worked out the life history of the microlepidopteron from material sent to him for examination, and he found the eggs and larvae of the insect were attacked in large proportions by endoparasites. It suffices to say that the number of *Pectinophora* that emerged from the capsules were, in proportion to their parasites, as 1 is to 13. According to observations made in Italy, most of the endo-parasites were injurious to the larvae rather than the eggs. These natural enemies, which belong to the Hymenoptera, are 1) a braconid, in great numbers and represented by males and females, 2) three chalcidids, one of which attack the eggs of the microlepidopteron, while two, represented by females only, attacks the larvae, 3) a proctotrupid, represented, in the collection made, by one female. The author describes these endo-parasites, but does not identify them specifically.

In order to utilise these natural enemies in the control of the microlepidopteron, it seems advisable that, when the cotton harvest is finished, the workers should examine the fields and remove all the bolls still remaining on the plants. These capsule should be placed carefully, avoiding crushing

(1) See R., Jan 1919, No. 140, see also R., Feb 1919 No. 260 (Ed.)

(2) See R., Dec., 1918, No. 1435 (Ed.)

them, in large boxes whose side walls are provided with at least four openings covered with wire gauze with holes large enough to allow the endoparasites to escape while retaining the adult microlepidopteron. The boxes should be placed in the plantation at intervals of 150 feet apart, and raised above the soil on stones so as to prevent their contents getting damp.

406 - *Grapholitha leplastriana*, a Microlepidopteron Injurious to the Cultivated Cabbage, in France. — DE JOANNIS, F, in the *Bulletin de la Société entomologique de France*, No. 17, pp. 234-237 Paris, 1918.

The author states that he has taken, on August 15, 1918, at Niort (Deux-Sevres), *Grapholitha leplastriana* Curtis, a microlepidopteron so far with few records in France.

The species is considered as an English one, but it is occasionally found, besides in France, in Austria-Hungary, Roumania, and in Italy.

Though it feeds on the wild cabbage, the larva of the microlepidopteron also feeds on the cultivated cabbage, as was shown by rearing experiments carried out by C. G. BARRETT in England; it does not appear, however, that the larvae have been never observed attacking cultivated cabbage spontaneously. The only, and that a rather vague, indication in this respect is that L. DE JOANNIS took, in 1884, about 15 specimens of *Grapholitha leplastriana* in a railwayman's garden near Douvres; in the garden about 50 cabbages were growing, and had probably served as hosts to the larvae of the microlepidopteron.

This *Grapholitha* has caused serious damage in Italy. In August, 1912, Sig. CECCONI wrote that the cauliflower crops in the neighbourhood of Fano (Marches) were seriously attacked by the larvae of a microlepidopteron that the author, after examining the adults, was able to identify as *Grapholitha leplastriana*. The larvae feed inside the tops of the young plants, causing them to decay rapidly. Sig. CECCONI published a special paper the year after on the cause of the trouble, which has been long known to the farmers of that region.

407 - *Agriotes lineatus*, a Coleopteron Injurious to the Vine, in Italy — FABIANI, C, in the *Giornale vinicolo italiano*, Year XLV, No. 8, pp. 71-72 + 2 Fig. Casale Monferrato, 1910.

In the province of Novara the larva of *Agriotes lineatus* L. (French: "taupin rayé"; English: "click-beetle") has caused during the last 2 years or so, frequent and serious damage to the nurseries of grafted American vines. The larva can be found in the nurseries towards the middle of June, when the tender shoots of the scion begin to show; it remains hidden some time in the upper layers of the mounds of earth covering the young plants and precisely in proximity to the point of insertion of the graft. Soon after, it attacks the young shoots close to where they are inserted, rings them, presses them closely and pierces them thus causing them to dry up (1).

(1) The damage done to the buds of young vines by the larva of a related species (*A. obscurus* L.) has been long known. Compare REH, L., *Die Tierischen Feinde*, in SORAUER P., *Handbuch der Pflanzenkrankheiten*, Berlin, 1913, III. Bd., S. 483 (Ed.)

The damage caused becomes less noticeable and is gradually reduced to very little as the temperature rises and the shoots become stronger.

The various methods of controlling the attacks of the beetle on cereals have been tried in the case of the vine, but, so far, no clearly-defined results have been obtained.

408 - The "Mulberry Scale" (*Diaspis pentagona*) Observed in the Peach Tree and Nectarine Tree, in France. — VAUSSIÈRE, P., in the *Bulletin de la Société entomologique de France*, No. 18, pp. 242-243, Paris, 1918.

In August, 1918, *Diaspis pentagona* Targ. was observed on peach and nectarine trees in private property at Menton-Garavan. In the following month the scale was reported from other parts of the department of the "Alpes-Maritimes".

409 On the Biology of *Stephanitis pyri* and on the Damage it causes to Pear and Apple Trees in France. — LERAILLON, A., in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 1, pp. 39-43, Paris, 1919.

The small bug known in France as the "tigre du poirier" or "pear-tiger" (*Stephanitis pyri*, syn. *Tingis pyri*) has caused serious damage to pear and apple trees during the year 1918 in certain regions of the "Haute-Garonne". The observations made by the author on trees grown on walls, in pyramids or in cordons in the Experimental Garden of the Horticultural Society of the Haute-Garonne, from May 18 to December 4, 1918, are summarised below.

According to workers who have described the life-history of the "pear tiger" the insect is most abundant in summer, causing damage chiefly in August and September (1). As a matter of fact, according to the author, it appears in spring and persists throughout the growing period of the fruit trees that it attacks. After May 18, many of the apple and pear trees (in espaliers or cordons) examined by the author were already infected by the parasite. At that time the leaves attacked had not suffered much, and as yet showed no traces of the discolouration that appears after the insect has been sucking for some time. On June 26, the bug had multiplied greatly and the fruit trees in the Garden hall, in consequence, suffered considerably, judging from the great number of the discoloured leaves. Observations made on August 8, September 26 and October 31 showed that, during the last period of summer and the beginning of autumn, the damage caused by the insect kept on increasing. It was noted that on November 11 and even on December 4, *S. pyri* was still fairly common on the last leaves of the apple-trees on which they had been observed since May 18 (2).

(1) The presence of the bug and the damage it causes have been recorded before that period as well at the beginning of spring (cf. LEONARDI G., *Gli insetti nocivi*, etc., Napoli, 1910, Vol. IV, p. 68. R. MINISTERO DI AGRICOLTURA, INDUSTRIA E COMMERCIO, *Entomologia agraria* (Munuscolo redatto dalli R. Stazione di Entomologia agraria in Firenze, diretta dal Prof. Bertesci), Florence, 1915, p. 343) and in May (cf. GRANDI G., *Dispense di Entomologia agraria secondo le lezioni del Prof. F. Silvestri*, Portici, 1911, p. 82 (Ed)).

(2) According to LEONARDI (op. cit.) the insect can be found in greater or lesser number throughout the year. (Ed.)

The "pear tiger" is generally considered as harmful to the pear-tree only and is rarely recorded as feeding on the apple tree (1).

The author's observations show that the two kinds of fruit tree are attacked to an equal extent by the insect in question and that all the varieties of apple seems uniformly apt to harbour the parasite. On July 26, the author noted, among the espalier or cordon apples, which were several years old and bore numerous discoloured leaves owing to the attacks of the insect, the following varieties: — "Calville blanc", "Reine des Reinettes", "Reinette dorée", "Reinette jaune d'hiver", and "Museau de Lièvre". On August 8, a number of young apple-trees, only planted in the spring of 1918, were also invaded by the parasite. Amongst the trees were the varieties "Empereur Alexandre", "Api doré", "Reinette de Caux" and "Transparente de Croncels".

In one and the same enclosure, all the apple and pear trees, when not facing the sun in the same way, are not all attacked equally by *Steph. pyri*. The bug abounds especially on trees exposed against walls that get the sun during the warmest hours of the day. The parasite is less numerous or is even completely wanting on trees facing north or east.

On the other hand, on trees grown in pyramids and placed inside the enclosure and not against the walls, it can often be observed that *Steph. pyri* invades the leaves at the base of the plant, i.e., near the soil. In every case, however, the invasion of the trees, whether in espaliers, cordons or pyramids, extends progressively from the base to the summit.

When a pear or apple tree is invaded by just a small number of "tigers", it suffers little, the damage being limited to the decay of a few leaves. But, as often happens in the south of France, and as was the case in 1918 in the Haute-Garonne, when it is a question of a strong invasion of these bugs, the trees most attacked suffer great damage. Nearly all their leaves end by being greatly affected and incapable of fulfilling their function as much owing to the excreta of the insect covering the under side of the leaf with a sort of very adhesive varnish to which large number of larval skins remain attached, as to the pricks and suction of the sap. The fruits only develop under very unfavourable conditions, and when the bug abounds on the same trees for several consecutive years, the trees become very sickly.

The author thinks that the only suitable remedies against the "pear tiger" consist in spraying the under side of the trees, with substances that kill the bugs either by simple contact or by asphixiating the insects with the toxic vapours they give off (nicotine vapour or hydrocyanic acid).

(1) GRANDI (*op cit*) states that it is very injurious to apple and pear trees; LEONARDI (*op cit*) says that the insect causes serious damage, especially to apple and pear trees; KIRCHNER, O., *Die Krankheiten und Beschädigungen unserer landwirtschaftlichen Kulturpflanzen*, 2. Aufl., Stuttgart, 1906, S. 468, 477, 539, records it from the peach and apple; REH, L., *Die tierischen Feinde*, in SORAUER P., *Handbuch der Pflanzenkrankheiten*, 3. Aufl., Berlin, 1914, III Bd., S. 527, says it occurs on pear, apricot, peach, cherry and walnut trees. (Ed.)

410 - *Eumarchalia gennadiosi*, a Dipteran Injurious to Carob-Beans in Italy.
— DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, and. Half-Year, No. 5,
pp. 287-297 + 5 Figs. Florence, 1918.

The author first describes the adult, pupa and larva of *Eumarchalia Gennadiosi* (March.) Del Guercio and discusses the systematic position of the species. A few notes are given on the biology and habits of the insect.

The fly, which has so far been recorded only from the provinces of Bari and Lecce, lays its eggs in the very young fruits of the carob; the newly-hatched larvae feed on the tissues of the carobs whose growth is in this way stopped to such an extent that they get no bigger than vetch pods or those of a very small pea and show external zones of depressions of varying size and true constrictions. In the worst cases, after the adult dipteran has emerged, the fruits it has attacked dry up and fall to the ground.

The insect, which has several generations in the year, always attacks the tenderest fruit, passing from the early to the late ones that are hardly ever wanting on the tree or by returning to fruit that had been attacked previously but which could still harbour eggs and larvae.

In 1914, the carob-crop was extremely reduced in the province of Bari; in 1912, the insect attacked 50-60 % of the fruit in the province of Lecce.

As regards the control of the parasite, an efficacious way is to collect, at the end of the summer, all the incompletely developed or deformed fruit, which are easily seen on the plant; after having been stored, these fruit could be used as cattle food or in some other way.

If the carob-tree is attacked simultaneously both by the Dipteran and by *Oidium Ceratoniae*, suitable strengths of polysulphides of lime or washes with sulphur as a basis may be tried against both insect and fungus.

[410]

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

411 - Agriculture and Forestry in Macedonia (Contribution to the Flora of Macedonia: I). — TURKILL, W. B., *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, Nos. 1 & 2, p. 253-254 London, 1918.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

At present cultivation in Macedonia is only carried on in limited areas and by primitive means. Little or no rotation of crops is observed, but land is often allowed to lie fallow for several years, and the only "dressing" the fields commonly receive is the turning on of sheep in spring and autumn. The ground is broken by a one-handled wooden plough, generally made from a single tree trunk and drawn by a pair of oxen or buffaloes. Sowing is accomplished by making a hole with the big toe for each grain, or the seed is merely scattered over the stubble and ploughed in. The soil is naturally very fertile in many of the valleys and plains.

Reaping is done by hand, and the unbound sheaves are threshed by the tramping of animals (oxen, cows, donkeys, ponies) round and round the smooth threshing-floor of hardened mud, generally dragging after them a portion of a tree-trunk, which acts as a wooden roller, or a piece of flat timber like a sledge, slightly turned up in front and with a man or children sitting upon it. The grain is winnowed by the mixture of straw and grain being thrown up into the air with forks of several broad prongs, or with wooden shovels. The cereals chiefly cultivated are wheat (bearded and non-bearded varieties), maize, barley, and oats.

Tobacco cultivation is an important industry in Macedonia, and many fields of it are grown in most districts. In the villages the gathered leaves are strung in rows and hung to ferment under the eaves of houses and barns. Cotton has been grown in the Strumia Plain and elsewhere. Round Langana and in other districts the opium poppy is cultivated.

Viticulture is important in the Struma Plain. Several kinds of grapes are grown for wine-making and for manufacture into raisins.

Fruit cultivation should be a financial success in Macedonia if good varieties of trees were introduced and markets rendered available. Many of the fruits are small and evidently little or not at all removed from wild types. In June abundance of luscious cherries — red, white, and black — may be gathered near most villages. In July, plums, pears, and peaches of several kinds are ripe, as is also a small kind of apricot and the white mulberry. Later, quinces, pomegranates, grapes, and figs ripen. Watermelons are brought to perfection in Macedonia.

Forestry is non-existent in Macedonia. The scarcity of trees is most noticeable, especially in the districts around Salonika, which are absolutely bare except for the shrubby *Quercus coccifera* and low herbage. Inland trees occur, but nearly always singly or in small groups, seldom worthy of the name of woods. *Quercus conferta* seems the tree most frequently used for house timber in the inland districts. It is the commonest tree in many districts and also occurs as a nullah shrub. In the Struma Plain, elm trees reach a good size, and isolated planes are well developed in various localities. The comparative scarcity of trees is probably due to several causes. In the first place the Turks have burnt, or otherwise destroyed, many forests in the Balkans, in their wars with brigands and insurgents of various kinds. Much timber has been used by the inhabitants for house-building, plough and cart making, etc., and for firewood and charcoal burning, and no trees are systematically planted in the place of those cut down. The flocks of sheep and goats of the nomad shepherds wandering over the hill country prevent new woods springing up naturally, by nibbling down the young shoots, for in the dry summer, when every blade of grass on the hills is scorched and brown, any young vegetation forms food for the scraggy animals. Lastly the severe winter winds are not encouraging to tree growth.

412 - **Animal and Vegetable Production in Finland.** - GOOSSEN, O., in *Intern. Usvoyen. Year III*, No. 39, pp. 809-811, No. 40, pp. 811-891. Amsterdam, September and October, 1918.

In 1914 Finland had 3,200,401 inhabitants. Agriculture in a wide sense — large and small crops, forestry and breeding — employed about $\frac{2}{3}$ of the population. A census taken in 1910 showed the land to be divided up as follows: arable land 5.7 %, meadows and grassland 2.8 %, forests 57.1 %, uncultivated land (marsh) 34.4 %. Cereals cannot be grown in all parts of the country.

CROPS. - The northern limit for barley is approximately the 68th N. parallel, for rye the 66th, for oats the 65th, for flax and hemp the 64th, and for wheat the 61st. Wheat can, therefore, only be grown in the south of Finland. The northern limit for a good potato yield is approximately the 66th N. parallel, and the production supplies in great part the native demand. In the past the Finnish cereal production largely exceeded the local requirements, but the increase in population has gradually stopped exporta-

tion. The cultivation of barley and rye is also decreasing, but that of oats and potatoes is increasing. In 1910 the principal crops were distributed as follows (acres and percentage of total crops): — Wheat, 7805 (0.2 %); rye, 591 955 (12.8 %); barley, 272 762 (5.9 %); oats, 986 718 (21.4 %); miscellaneous cereals 16 457 (0.4 %); peas and beans, 18 915 (0.4 %); vetch 3 398 (0.07 %); potatoes 171 147 (3.9 %), root crops 30 667 (0.7 %); buck wheat 657 (0.01 %); flax, 12 240 (0.3 %); hemp 4 004 (0.1 %); mixed crops of vetch, oats, and barley 66 159 (1.6 %); clover and pasture 1 838 154 (39.9 %); fallow land, 573 678 (12.4 %). The total acreage under cultivation in 1910 was, therefore, 4 605 804 acres.

FORESTRY. — Of European countries Finland is the richest in forests next to Russia. The forests cover about $\frac{2}{3}$ of the total area (the percentage varies from 57-63 %), but are not all composed of high trees. The agrogeological conditions of most of the country, as well as the climate, are more favourable to forestry than crops. Transport is facilitated by the enormous network of water-courses and the fact that, in winter, the whole country is covered with thick snow. The rivers also have falls which make it possible to construct mechanical saw mills. The forests are denser and more extensive in the centre of the country. The chief trees are *Pinus sylvestris* and *Picea excelsa*, to which must be added beech and, in southern Finland, oak. The Finns were very late in understanding the value of wood as an export. In old days the forests were considered primarily as places for hunting; later the wood was utilised for building, and finally, the forests were burned to make way for crops. It is estimated that in 1915 there were 49 million acres of forest in Finland, about $\frac{2}{3}$ of which belonged to the State. In 1912, 1913, 1914 and 1915 the State forests yielded 86 181 046, 74 107 320, 86 903 559 and 60 778 818 cubic feet of timber respectively. During 1870-1874, 21 574 865 cubic feet of sawn timber (at least 6 $\frac{1}{2}$ ft. long) were exported, and this amount gradually increased till in 1913 it reached 115 743 804 cubic feet. The war naturally put an end to this expansion.

FISHERIES. — Finland has numerous lakes, rivers and marshes. The area of the lakes and rivers is 16829 sq. miles, or 11.7 % of the total area. In addition to sea and coast fishing, fishing in the marshes and rivers is a large source of food supply; of 441 665 lb. of salmon caught in 1914, 237793 lb. came from the sea and coast and 203 872 from the lakes and rivers. In the same year $\frac{1}{4}$ of the smelts caught came from the salt water. In Finland landowners generally own water and fisheries as well. By the Finnish law the waters are the property of the parish or the villages near them. Each inhabitant has the right to fish, but official measures are enforced to prevent abuse of this right. Very little fish is preserved; it is nearly always exported fresh.

BREEDING AND DAIRY INDUSTRY. — There are many natural meadows in Finland and, stock breeding being on a relatively large scale, a large quantity of butter is exported. During recent years, however, the number of cattle has remained almost stationary. The production of butter and cheese has increased continually, especially in the cooperative establishments which

in 1914, supplied 85 % of the total production of butter. In that year 29 741 500 lb. of butter and 5 306 400 lb. of cheese were produced. These figures refer to the production of commercial establishments and do not include that of small farms. Butter is exported chiefly to Sweden and the United Kingdom.

413 - The Agricultural Possibilities of Morocco (1). — MÏGER E., in *La Vie agricole et rurale*, Y. II IX, No. 9, pp. 115-117, + 8 Photographs + 1 Map + Bibliography of 4 Publications. — PARIS, MARCH 1, 1919.

After describing briefly the geographical, climatic, agricultural, ethnic and economic conditions of Morocco and its products and commerce, the author reviews the different crops now grown or capable of being developed and the conditions of cattle-breeding. According to the statistics for 1916 there were in Morocco 62 950 camels, 140 545 horses and mules, 250 980 asses, 856 078 cattle, 30 000 pigs, 4 054 335 sheep, and 12 227 070 goats. The numbers are, however, believed to be much larger. All these different stocks in Morocco have excellent qualities and undeniable possibilities for improvement, but the conditions under which they are kept have caused them to deteriorate.

CATTLE. — Their origin is but imperfectly known. According to some they belong to the Atlas breed, according to others to the Spanish, and according to others they are local. In former times they were used as pack and saddle animals; today they are kept chiefly for slaughter. The cows are not good milk producers, but might become so. Some crosses have been made. The introduction of Limousin bulls and Breton and Montbéliard cows has given good results. The use of Indian zebu bulls for breeding has been started in the hope of obtaining animals more suitable for draught and slaughtering (the yield should rise from about 45 % to 60 % or even 70 %) and more resistant to disease, especially pyroplasmosis.

SHEEP. — They belong to three principal breeds. — 1) the smallest (110 lb.); thin limbs, good quality wool and meat, resembling the Oran sheep and found chiefly in the mountains and table-lands; 2) that of the coast, found in Chaouia and the neighbourhood of Fez; longer and flatter, and characterised by a very developed sort of dewlap, wool coarse and flesh without flavour; 3) the best, found in Gharb, Tadla, etc., meat excellent and wool good, may weigh as much as 154 lb., head usually red or black, chest and loins broad, similar to the Merino breed in character.

The Moroccan wools, much utilised during the war, are divided into 3 classes: — 1) Aboudia, compact strand, with even, soft, silky and white fibre; it is the best quality; 2) Urdighia, loose strand, very regular, stronger but a little more common; 3) Beldia, irregular strand, rough, breaking often, and very variable according to the district it comes from.

GOATS. — Very strong, producing little milk, but meat, eaten by the natives, as well as hair and skins of great value. They are found in large numbers all along the coast. The breed seems local. Maltese, Spanish, and even Angora goats are found.

(1) See R. March, 1919, No. 272. (*Ed.*)

HORSES. — Barbary breed believed to descend from crosses between African zebras and imported horses. They might be improved by better treatment and crosses with pure-blood, 50% Anglo arab, and good Algerian stallions.

ASSES. — Usually small, docile, quiet, strong and resistant, used as pack animals and for farm work.

MULES. — One of the most valuable resources of Morocco; about 25 000 in number and absolutely remarkable for their qualities.

PIGS. — Pig breeding, previously unknown, is developing with wonderful rapidity. The pigs are of Spanish breed, more or less crossed with Algerian varieties and already influenced by foreign importations; they are black or spotted and often weigh 220 lb., even 418 lb. They might be improved by crossing with Craonnais, Yorkshire, or better still, Berkshire breeds.

POULTRY. — There are large numbers of poultry. In 1916, 47 212 quintals of eggs, of the value of 961 212 francs were exported.

OSTRICHES. — Existed in Morocco from prehistoric times but have entirely disappeared. Breeding experiments at Meknes and Marrakech have proved very satisfactory.

APICULTURE. Little developed except in the south, which exports from 1200 to 1500 quintals of wax each year (Mogador).

SILKWORM BREEDING. (1)

CONCLUSIONS. Morocco is a country in which all kinds of animals may be profitably bred. The native methods are primitive and unsatisfactory, feeding is insufficient, very irregular and entirely dependent on the resources of the district and moment, hygiene and selection are unknown and the present value of the stock is due solely to its intrinsic qualities. The possibilities are, therefore, numerous and sure. If the meadows be improved and increased, the cultivation of artificial fodder hay and ensilage developed, shelters and water reservoirs built, and reproduction supervised, the results will be astonishing.

414 — **The Agricultural Position in Ethiopia (The Economic Position of Ethiopia 1913 1917).** — BOUCOURIAN M., in *Recherches Coloniales et Documentaires publiées par le Comité de l'Afrique Française et le Comité du Maroc*, No 1, pp. 17-210. 1 Map. Paris, 1918.

In view of the present social condition and administration of Ethiopia it may be understood that the economic position of the country is not as satisfactory as might be supposed considering the incontestable wealth of its natural resources.

AGRICULTURE. — The agricultural methods used by the natives are all very primitive and have not changed since remote times. In the total absence of statistics it is impossible to estimate, even approximately, the annual cereal yield of the cultivated districts, but there is no doubt that all the land suitable for cultivation is not cultivated. Recent estimates made in the Harrar province by English agriculturists, show that, in this part of Ethiopia alone, 20 000 square miles of good arable land are uncultivated.

(1) See *R. P. h.*, 1919, No 234. (Fa.)

In the Djigdjiga district, bordering on British Somaliland, barely $\frac{1}{3}$ of the land is cultivated; lack of labour is said to be the chief cause of this state of affairs. It should also be noted that as none of the fields in Ethiopia are fertilised in any way, it is absolutely necessary to let them rest periodically. After a period of fallow the first crop is usually "dourah" (sorghum) or "tief" (millet). "Dourah" roots have the advantage of loosening the soil; they spread chiefly along the surface and break it up without raising it. When burnt they give a good fertiliser. Two thirds of the inhabitants of Ethiopia live on cakes made of "dourah" or "tief" flour.

Wheat does well everywhere in Ethiopia at moderate altitudes and in the high inhabited valleys. The principal centres of production are the Tchertcher, Djirou, Sallalé and Tigré districts, but everywhere at altitudes between 4 500 and 5 900 ft. the fertile soil could give two crops a year. Unfortunately the wheat seed is never carefully chosen and is not always suited to the soil. As a result of the methods of cultivation also the yield of wheat is only 10 times the amount of seed sown. Whereas in Europe the yield varies from 8.75 to 14.26 cwt. per acre, the maximum yield in Ethiopia never exceeds 2.29 cwt. Sown at the beginning of the rainy season, from the middle of June to the end of July, it is harvested about the middle of November. The ears are cut with a sickle and threshed by being trodden out by oxen. The flail is unknown. Nearly all the wheat grown in Abyssinia is soft. A variety (not buck wheat) called black wheat, is especially used for making "talla" (a native beer) and alcohol. Although the area over which wheat might be grown is estimated at 12 to 15 million acres, the annual yield of this cereal, which it is true, is not of primary importance as a local foodstuff, does not exceed 196 800 cwt.

Whereas millet grows particularly on all the high table lands and sorghum in the hottest districts, barley does well throughout Ethiopia. It is nearly as important a crop as millet, and is usually harvested after it, in January and February. The yield is small, about 8 times the quantity of seed sown. Barley is almost the sole food of horses and mules during drought, and is also used for making "talla". After millet, barley and sorghum, chick peas are most largely grown, the annual yield varying from 12 000 to 15 000 metric tons.

Market garden crops, properly speaking, would find favourable conditions in most of the provinces, near permanent water courses, and would greatly improve the native food supply but these crops require, on the one hand, too much care, and, on the other, are not encouraged by the authorities, because they would greatly complicate the levying of tithes and of extraordinary contributions. In addition to the kitchen gardens cultivated by foreigners (Armenians and Arabs) in the Harrar district and near the centres inhabited by Europeans, the only vegetables cultivated in Ethiopia besides chick peas are lentils and Jerusalem artichokes. Nevertheless it would be possible to harvest at all times of the year potatoes, kidney beans, peas, beans, horse beans, salads, cabbages, artichokes, asparagus etc. Orchards could be planted also throughout Harrar. As in certain European

countries, the potato might become the chief food of the inhabitants. The Gallas peasants grow them without selecting them or giving them attention and appreciate neither their value as a food nor their taste. The only buyers are Europeans, and the potatoes are sold on the Addis-Abeba market at 8 to 10 *thalers* (about 12s.) per cwt., a very high price as the yield easily reaches about 63 cwt. Potatoes are of no value for export as the cost of transport from the table lands to the coast is too high, but their cultivation should be encouraged and propagated by the local authorities in order to increase the food supply of the country.

On the whole the cereal crops were very mediocre, or even bad, in 1916 and 1917. By recommending, or even favouring market garden products and vegetables, by temporarily reducing the market dues, the Government might perhaps create a movement in favour of these crops so as to compensate the shortage of cereals. All these products of primary necessity which have just been reviewed are naturally the object, within the country, of transactions which it is impossible to enumerate. Other products in which there is a large trade are pepper, known as "berberi", similar to Nepal pepper, "guecho", the dry leaves of which play the part of hops in the manufacture of "talla", and of ferment in that of "tetch". "Talla" and "tetch", or "tedj" (hydromel) are the two national drinks of the country.

The Arabian coffee shrub grows wild in some provinces, especially in Djinnia and Kaffa, of which it is said to be a native. It gives fairly good crops, but the cultivation of coffee is practically non-existent. The few attempts made by the natives have given very mediocre results. In the Harar province and some of the Aroussis valleys the native cultivates it with more care. Coffee sowing, usually supervised by the Yemen Arabs or the Gallas instructed by them, is carried out over small areas. At six months the seedlings are transplanted at the rate of about 1000 per hectare (2.47 acres). During three years it is necessary to weed, hoe, and irrigate wherever possible at least once a week. In these districts the first crop is harvested after the third year, from June to December. The bushes bear fruit nearly all the year round. The opinions of colonists or European buyers as to the annual yield per bush in Ethiopia vary greatly. The average yield of good Brazilian plantations (66 lb.) seems easily attained in Ethiopia by bushes from four to fifteen years old so long as they are well tended and the plantations made in good soil, capable of being irrigated, at an altitude of from 5250 to 5900 ft. Profitable attempts might also be made to grow other species of coffee in the low districts where irrigation is impossible.

Cotton has always been grown and woven in Ethiopia. Through lack of attention and seed selection the native cotton bush has deteriorated, nevertheless the pods are still of average size and the staple fairly long. Attempts at rational cultivation made by the French colonists near Dirré Daoua, at Mollou, and on the banks of the Kassam, have given promising results. Plantations at Egyptian cotton do not, however, appear to do well. The local demand will absorb the production for a long time to come. The large cotton fields are found chiefly in the Tchertcher district, between the

Kassam and Baltchi escarpment, along the Bossette mountains and in the Tigré district; some are also found on the islands of the Zouai lakes and in the Kambata region. In the Aouache valley young bushes are often destroyed by frosts, which occur in clear weather near the water. As a rule, however, it would be possible to obtain from 700 to 900 lb. per acre in all the alluvial soils where irrigation is possible. In reality the natives are content with a very low yield; fearing fever they do not irrigate, and hoeing and weeding are done very irregularly.

Tobacco cultivation has always been neglected, although it does very well in the South and Sidamo district. The Gouragués and Gallas are, however, the only natives who smoke, the Abyssinian rarely doing so. For some years this crop has been controlled by the "Régie co-intéressée des Tabacs éthiopiens", but the value of the export does not exceed some few thousand francs a year.

As special crops, restricted to certain districts and, like the preceding ones, grown without care or method, may be mentioned maize, which gives very profitable yields, especially in the Ninjar and Harrar districts, and "kat", restricted to the neighbourhood of Harrar-Ville. "Kat" is a bush cultivated for its leaves, much in demand by the natives for their exciting and intoxicating properties. By chewing it is produced a sensation of hunger, followed by transient exhilaration and a quiet intoxication. It takes the place of alcohol for the Mussulmans, like Indian hemp. About 20 metric tons are exported annually, consumed almost exclusively in Arabia and the countries bordering on Ethiopia.

About a dozen years ago a fairly large number of rubber trees were found in the forests of the Kaffa and O allaga districts. Their exploitation was undertaken by a society, the "Régie co-intéressée du caoutchouc", and appears to have been badly managed as, since 1910, the quantity of rubber exported has been gradually decreasing.

Among the vegetable products which have been completely neglected, but might give rise to a profitable trade, are castor oil and flax. These two plants grow wild almost everywhere in Ethiopia. Castor-oil seed, roughly crushed, is only used by the natives to prepare raw skins used locally. Flax is harvested only for its seed, which is fed to stock; its textile properties are unknown to the inhabitants. The cultivation of sugar cane and ground nuts has never gone beyond the experimental stage.

FORESTS. Before the arrival of Europeans in Ethiopia nearly all the high table-lands were covered with forests, but the ever increasing consumption of wood and particularly the total absence of all preservation measures, have stripped several regions. The inhabitants in order to obtain land for their crops, frequently burn the forests. For example the Kounni forest, in the Tchercher district which covered all the slopes of the table-land is almost entirely destroyed. In the Ouallaga, Kaffa and other western districts there are, however, still very fine forests, almost entirely unexploited. All the kinds of trees in these forests have not yet been determined, and practically only the most valuable ones are known. These are — "zegba", known as "herbersa", a resiniferous tree

of the pine family; "gatera", or juniper, which in some districts grows enormous; "tecerencia", with very hard wood, used for making rifle butts; "chola", a variety of sycomore; "ouenza", a species of *Ficus*; "koll quali" or *Candelabra euphorbia*; about 50 species of acacia, including the parasol-shaped mimosa acacia, known as "tadetcha". From a commercial point of view only the first four trees are of value. The eucalyptus, introduced by a European about 20 years ago at the request of the Emperor Menelik, does so well that it may perhaps eventually counteract the cutting of the forests, so long as the Government takes the initiative in laying down measures and assuring their execution.

BREEDING. — The Ethiopian pasture lands exceed the cultivated lands in area. They are firstly vast stretches of desert where grass is hard and scant. The grass lands on the lower slopes are already better, but the really fertile meadows are on the high table-lands or mountain sides. Here hay is usually harvested, whereas in the plains and on the medium table-lands the dry grass is burnt after the dry season. Artificial meadows are unknown to the native. Certain varieties of alfalfa could be acclimatised everywhere, and would make it possible to lay in reserves of fodder for times when hay is lacking. It would also be possible to cultivate beets, mangelparsnips and Swedish turnips to counteract the scarcity of fodder which puts a temporary stop to all breeding, the underfed animals falling a prey to all sorts of diseases.

Nevertheless the cattle are strong. They consist of Zebus which may be divided into two classes, the desert animals, with a well-developed bone frame, and the animals of the table lands, smaller, with strong shoulders, short legs and bulging buttocks. The net meat yield is much greater for the second variety; rational selection and continual care would give valuable results with such a fine breed. Government initiative is also indispensable in this case. The stock of Abyssinia cattle is estimated at 10 million head. Every year plague kills 50 % of the calves and sometimes more. In 1917 it was yet more serious. The number of zebus slaughtered for meat is estimated at 1 500 000 a year. Prohibited for the last two years, the export of stock will probably never be profitable owing to the difficulties and the cost of transport, and the long delay at the coast, during which the animals deteriorate. For other reasons the export of frozen meat is not practical. Only the preparation of tinned meat could be considered (the average ox giving 264 lb. of meat net) on condition that it be combined with local tanning of the skins. On the high table lands horses, mules, and asses are bred as well as oxen. Minjar, Metcha, Choa and Sallalé are the chief centres.

The Abyssinian horse is of average height (13 $\frac{1}{4}$ to 13 $\frac{3}{4}$ hands); its son what sunken buttocks are similar to that of the Tunisian horse. It is very strong and very sure footed. Mule breeding is more profitable than horse breeding. The fine mules are much sought after as saddle animals; ambling mules are preeminently the mounts of high personages. The Abyssinian ass is barely 9 $\frac{1}{2}$ hands high, but it has a strength and en-

durance which makes it incomparable for transport over short distances. It is bred especially in Choa and North Ethiopia.

The camel is found in the Dankali and Somali deserts. Before the railway was laid at Addis-Ababa it was used for carrying heavy weights, of $\frac{1}{4}$ metric ton at the most, and left the table lands during the wet season. As its use is no longer indispensable in supplying the markets of the capital, it will be used less and less on the high table lands.

As in the case of cattle, Ethiopia has a mountain and a plain type of sheep, but the native does not breed them in the real sense of the word. In the plains the sheep usually live among the large herds of goats, very common in this country, bred especially for their skins. The wool of Ethiopian sheep is of little commercial value. Each landowner has a few which follow the zebu to the grazing land. The mountain animals do not weigh more than 66 lb., whereas those of the plains often weigh 99 lb. These latter (especially those of Onollo) have a short, hard wool which can, however, be woven; the natives make of it a coarse cloth used for making burnous. In spite of fluke worm, or distomatosis, very common in Ethiopia, there is no doubt that the rational breeding of sheep would give good results.

Pigs would also do well throughout the country, and, in normal times it would be easy to find suitable food - cheap cereals, beans, peas, potatoes, etc. Pig breeding will, however, only be profitable if preserving factories* are started, as local consumption is almost nil. Coptic Christians may only eat ruminants, and pig's flesh is forbidden to Mussulmans, who form about $\frac{1}{4}$ of the population.

VARIOUS ANIMAL PRODUCTS. Bee-keeping would be very profitable were it better understood. In many provinces the natives are content to collect the honey and wax in the brushwood, and when they do keep bees, it is by very elementary methods. Honey is indispensable for making "tedj", a distilled, fermented beverage giving a pleasant flavoured alcohol known as "araki". In spite of defective exploitation, the value of the wax exported reaches a high figure.

Among the special products of the South-west, especially Onallaga, civet may be mentioned; the civet cat which produces this viscous matter used to fix certain perfumes is not bred, but when captured is given food which increases the secretion.

POTASSIUM SALTS. - Recently important potassium salt deposits have been discovered in Abyssinian territory, near the frontier of Eritrea, about 47 miles from the small Italian port of Fatimari. According to experts these deposits contain at least 850 000 metric tons of salts containing 55 % of potash (K^2O). The "Compagnia Mineraria coloniale" has re-bought its rights from the lessee at the cost of 2 500 000 *lire*, and has begun to work the deposits. Thanks to the Decauville railway the monthly transports to the coast may be as great as 7000 metric tons. When this railway is also used for carrying skins and coffee, the export conditions by means of the Italian line will be improved (1).

(1) See *R*, 1918, No. 391 (Ed.)

415 - **The Use of Aerial Photography in Agriculture and Agricultural Instruction.** — BOUCHÉ H., (Note presented by M. H. Hitler), in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 10, pp. 351-355 and 358-362. Paris, March 12, 1910.

The use of aerial photography in agriculture and agricultural instruction may be of great importance—repairs of the land, details of the partition of the land and of the crops on an estate, description of the trees in orchards and other plantations, study of the form and utilisation of land according to its geological formation, relief of the land, of the hill sides, etc. In the districts devastated by war aerial photography might be used to estimate the damage done.

416 - **Cultural Experiments with Various Plants made from 1910 to 1914 at Sub-station No. 1, Beeville, Texas, U. S. A.** — BINFORD E. E., in the *Texas Agricultural Experiment Station, Bulletin No. 214*, 27 pp. + 4 Figs. College Station, Brazos County, Texas, April, 1917.

During the five years 1910-1914 the sub-station of Beeville, Bee County, Texas, started cultural and variety experiments to study the agricultural questions of South-west Texas. The crops grown were:—cotton, maize, oats for hay, legumes, grain sorghum, Sudan grass, (*Sorghum exiguum*), various fodder plants, market garden plants and citrus trees.

The weather conditions during this period are first rapidly reviewed. The average annual rainfall was 31.95 inches in two principal periods, spring and autumn. The average maximum temperature in August was 21.3°C, the average minimum temperature in January—5.2°C. The earliest frost was at the end of October, the latest, at the end of March. The results of the various experiments are then given.

COTTON:—The highest yield per acre in unginned cotton in the variety tests made in 1912 and 1914 was given by the Mebane variety (968.84 lb.), followed by the King (951.10 lb.), Rowden (923.13 lb.), Crowder (921.29 lb.) and Lone Star (834.11 lb.) varieties. A comparison between frequent and infrequent cultivation shows negligible differences in yield—684.4 and 681.7 lb. per acre respectively for the Mebane variety.

MAIZE.—In the variety tests, Thomas maize (25.44 bu. per acre) and Suicroppe maize (24.04 bu. per acre) gave the highest average yields in 1913 and 1914. Seed from 120 ears of Thomas maize was sown in separate plots. The yield obtained varied from 17.57 to 48.86 bu. per acre and was related to neither the weight nor the volume of the ear from which the seed was obtained.

Experiments on the effects of the rate of sowing were made in 1913, an exceedingly dry year, and in 1914, a very wet year. The rate of sowing varied from 2 420 to 9 680 stalks per acre. In 1913 the maximum grain yield per acre (10.90 bu.) was obtained with the thinnest sowing, and the thickest sowing yielded nothing. In 1914 the grain yield first increased with the thicker sowing until with 4840 stalks per acre it was 37.08 bu. an acre, it then decreased slightly as the rate increased, and reached the maximum (39.92 bu. per acre) at a rate of 7260 stalks an acre, then decreased again for greater thickness.

In 1913 and 1914 experiments were made on the distribution of plants

on the soil by sowing maize :— 1) at distances of 3 ft. in squares ; 2) in rows 6ft. apart, at distances of 18 in. ; 3) in rows 3 ft. apart in pairs 9 ft. apart, at distances of 18 in. On each plot was left a number of stalks corresponding to 4840 per acre. The average yields in grain were 23.40, 21.87 and 20.64 bu. per acre respectively. This shows that the distribution of the plants in the soil has relatively little importance, although greater intervals facilitate cultivating.

In 1912 cowpeas sown between the maize rows at the beginning of its development decreased the grain yield by about half that of maize grown alone. In 1913, however, cowpea sown later, when the maize was nearly ripe, did not affect the grain yield.

OATS. — In the comparative tests with oats for hay made in 1912 the varieties Texas Red Rust Proof, Hundred Bushel, Applier and Tennessee Turf gave 9 550, 8 830, 8 430 and 6 130 lb. of cured hay per acre respectively. The first variety proved very resistant to rust and did better than the others. The second and third also resisted well, but the fourth was badly attacked. In 1914, an excessively wet year, oats did badly. Texas Red Rust Proof oats, grown in rotation, which had given 4 960 lb. of hay per acre in 1913 only gave 2 220 in 1914.

COWPEA. — In rate of sowing experiments made in 1913 and 1914 the average yields in ripe hay were 2 375, 2 316 and 2000 lb. per acre for seed broadcast at the rate of 30, 60 and 80 lb. per acre respectively.

GROUNDNUTS. — In tests made with six varieties of groundnuts in 1912 and 1913 the average yields varied from 14.39 bushels per acre for Tennessee Red and 31.52 bushels per acre for Spanish. A comparison of sowing in lines 18 inches apart with sowing in lines 36 inches apart during the same period for all the varieties tested showed an average yield of 20.24 bushels per acre for seed sown in lines 3 ft. apart, and 23.38 bushels an acre for that sown in lines 18 inches apart.

ALFALFA. — Common alfalfa and Turkestan alfalfa sown in the autumn of 1911 yielded in 1912, 2 450 lb. and 2000 lb. of hay per acre respectively (total of two cuttings). Later tests with alfalfa were not successful.

Six varieties of bur clover (*Medicago denticulata*) grown from 1912 onwards, gave perfectly satisfactory results.

SORGHUM. — Of the grain sorghum varieties grown in 1913 and 1914, Blackhull Kafir gave the maximum yield with an average of 7 282 lb. of hay per acre (and 23.35 lb. of grain). The best distance apart in the rows is from 6 to 8 inches.

In 1912 rate of sowing experiments were made with the Amber and Sumac sorghum varieties which were sown in rows 3 ft. apart at distances varying from $\frac{1}{4}$ inch. to 6 inches. At these maximum and minimum distances the hay yield per acre was 1.45 tons and 2.40 tons for Amber sorghum and 6 15 tons and 8.20 tons for Sumac sorghum. In 1912 and 1913 these two sorghums were sown in close rows, using 25.50 and 100 lb. of seed per acre. At these rates of sowing the average respective yields of hay per acre were : 3.90, 4.47 and 4.02 tons for Amber sorghum, and 8.00, 8.70 and 7.98 tons for Sumac sorghum.

Sudan grass sown : — 1) in rows 3 ft. apart ; 2) in rows 18 inches apart ; 3) broadcast, yielded ~~18~~ 249, 10 104 and 9 400 lb. of hay per acre respectively. By using 15, 20, 30, and 40 lbs. seed per acre, average yields varying from 4.40 to 4.55 tons per acre were obtained. Mixtures of Sudan grass and cow-pea sown for hay did not give satisfactory results.

PREPARATION OF SEED BEDS. — Experiments on the best method of preparing seed beds, made in 1913 and 1914 showed that listing or ploughing to a depth of 6 to 8 inches prepares soil best for maize, cotton, and kafir sorghum.

POTATOES. — In the variety tests with potatoes the best results were obtained with Bliss Triumph, Early Rose, Irish Cobbler and Gold Coin. Early varieties seem best suited to these districts.

In fertilising tests with potatoes the highest average yield (89.83 bu. per acre) was obtained by applying 200 lb. of cottonseed meal per acre and the same quantity of superphosphate. The average for all the unfertilised plots was 60.95 bu. per acre. The minimum yield (52.24 bu. per acre) was obtained with the application of 400 lb. of potassium sulphate per acre. These results show that in this soil the best potato yields are obtained with superphosphate mixed with some nitrogenous fertiliser.

MARKET GARDEN CROPS. — The plants recommended are : — beets, Early Egyptian and Blood Turnip ; cabbages, Flat Dutch and Drumheads ; cauliflowers, Snowball, Gilt Edge, Dwarf Erfurt ; lettuces, Big Boston, Wonderful, California Cream Butterhead ; potatoes, Bliss Triumph, Early Rose, Irish Cobbler, Gold Coin ; tomatoes, Earliana, Stone, Acme, Dwarf Champion ; onions, Bermuda ; radishes French Breakfast, Scarlet Globe, Scarlet Turnip, Half Long Scarlet ; peas, Extra Early Alaska, Marrowfat and Gradus ; green beans, Burpee's Stringless Green Pod and Bountiful ; dry beans, California Pink.

CITRUS TREES. — Experiments made with different citrus trees at the sub-station show that the best varieties for the district are Dugat and Satsuma oranges which give very satisfactory yields. Lemons do not do well. Although grape fruit is less resistant to frost than oranges its gives good crops ; the Duncan, Pernambuco and Royal varieties are specially recommended.

CROPS AND CULTIVATION.

417 — Weather Conditions of the United States from an Agricultural Point of View.

WARD, DE C., in the *Quarterly Journal of the Royal Meteorological Society*, Vol. XLV, No. 189, pp. 1-19 + 1 Fig. + Bibliography of 41 Publications. London, January, 1919.

AGRICULTURAL
METEOROLOGY

Climate, especially temperature and moisture (atmospheric precipitation), has an absolutely predominating action on the geographical distribution of cultivated plants. The curve of precipitations of 500 mm., which follows fairly closely the 100th W. meridian (Greenwich) divides the land of the United States into two distinct parts, east and west. The precipitations of the eastern part are sufficient to make it possible to cultivate and develop farms by the ordinary methods without having recourse to

dry farming or irrigation. In the west, however, except in the N-W coastal district and some parts of California and the Rocky-Mountains, the rainfall is insufficient for cultivation by the usual means and dry farming and irrigation have to be adopted. These two parts may in their turn, be subdivided into five distinct districts or agricultural provinces.

In the eastern part (to the east of the Rocky Mountains) the land is fairly flat, except in the mountainous Apalachee district (Alleghanies). Latitude (and, consequently, temperature) has a predominating influence on the distribution of crops. The agricultural districts, therefore, follow each other regularly from the south to the north in accordance with the parallels, excepts in the Apalachee district, where the regularity is somewhat broken by the mountains. The five belts distinguished are: — 1) Gulf and Florida belt (cotton, oranges, rice, sugar-cane); 2) Cotton belt; 3) Maize and winter wheat belt; 4) Spring wheat belt; 5) Pasture and fodder plants belt.

The factor most greatly influencing the distribution of crops in the west is not temperature, but rainfall, which in its turn, is closely connected with the presence and development of the heights which dominate the whole district from north to south. The agricultural belts do not follow each other in the latitudinal sense, but in the longitudinal sense, from east to west, according to the mountain chains. Starting from the east there are, firstly three belts: — 1) Great Plains belt; 2) Rocky Mountains belt; 3) Interior arid belt. The Pacific coast district is divided into two belts: — 4) Northern coast belt; 5) Southern coast belt.

Geographical and climatical data on the principal plants cultivated are given below:

COTTON. — This is the most important and characteristic plant of the cotton belt, which produces $\frac{3}{6}$ of the world's supply of cotton. This district is limited in the north by the summer isotherm 19°C and, in the west, by the annual isohyete of 375 mm. The average duration of the frost-free season is about 200 days. Warm, moist weather from April to August favours the growth of cotton, and a cool, dry autumn improves the quality of the staple and makes it easier to harvest. Meteorological investigations into cotton have been made by KINCER (1).

MAIZE. — This is the typical agricultural product of the United States for $\frac{3}{4}$ of the world's production come from this country. The largest centre of production (Mississippi Valley) has the following climatic values: — 1) Average summer temperature, from 21° to 26°C ; 2) average night temperature above 14°C ; 3) duration of frost-free season, at least 150 days; 4) rainfall, from 625 to 1250 mm. or even more.

J. WARREN SMITH made a series of meteorological studies on maize (2). Its weather requirement varies greatly from one variety to another (3), so that the choice of a variety, and selection and hybridisation may greatly influence the geographical distribution of this plant.

(1) See *R* June 1918, No. 622 (*Ed*)

(2) See *R* Oct, 1918, No 1078. (*Ed*)

(3) See N 145 of this *Review* (*Ed*)

WINTER WHEAT. — Its area of distribution is limited at the south by the isotherm 10°C (from April 15 to June 15), at the north by the winter isotherm -6° . Winter wheat has almost the same rain requirement as maize, but its critical period is in March instead of July. Too cold a winter and too dry a spring are generally detrimental to it, and contribute to limit its cultivation towards the north and the west respectively. Its northern limit does not depend only on the isotherm 10°C during the two months preceding harvest, but is also dependent on : — 1) excessive rains towards the end of the vegetative period which cause bad attacks of rust ; 2) a mild winter causing a renewal of growth before the danger from the last frosts has entirely passed ; 3) in the southern provinces the sowing of wheat coincides with the cotton harvest ; as cotton is more profitable, preference is given it.

OATS. — Along the northern limit of the maize and winter wheat belt, from New England to North Dakota, oats are also grown, the principal centres of production being near the Great Lakes. Oats require a cool, wet climate ; their northern limit is formed by the winter isotherm $+1^{\circ}\text{C}$.

SPRING WHEAT — This is grown throughout Dakota, to the east of Missouri, in all the west of Minnesota, and in the east of Washington State. It is sown in April and harvested at the end of July and in August. Its northern limit is marked by the summer isotherm 14°C , which is only found in the western mountains. Meteorological studies on winter and spring wheats have been made by J. WARREN SMITH (1).

MEADOWS AND FODDER CROPS. — In the east this belt includes a large part of Wisconsin, Michigan, all the district between Canada, the Lakes Ontario and Erie, and the Atlantic, as well as the Apalachee mountain region. The cool summer, with an average temperature below 21°C , and the abundant rainfall (always above 750 mm.), encourage the growth of fodder crops, and the relatively fine weather at the time of cutting generally favours hay-making. In this district stock breeding and the dairy industry flourish. Here also is the greatest production of potatoes, which require a relatively cool and moist July (2).

Throughout the west fodder is the principal product. In the Great Plains the natural meadows of gramineae offer abundant pasture to the numerous herds. In the wet Pacific district gramineae are sown as fodder crops, whereas in the Rocky Mountains and dry districts of the interior, the most important plant is alfalfa which, thanks to its well developed root system, can to a large extent utilise the moisture of the soil.

Recently some sorghum varieties very resistant to drought have been introduced in the more southern provinces of the Great Plains. The Kafir variety flourishes in the district lying between the isohyets 400 and 800 mm., and its northern limit is marked by the summer isotherm 24°C . The Milo variety goes a little further north.

SUGAR CANE. — The district round the Mississippi delta, where the temperature is high (destructive thermal depressions rarely occur) and the

(1) See *R. Oct.*, 1918, No. 1078 ; (*Ed.*) — (2) See *R. Oct.*, 1918, No. 1078 (*Ed.*)

abundant rainfall exceeds 1 500 mm., is favourable to sugar cane which is widely cultivated there.

ORANGES AND OTHER CITRUS FRUITS. — The Florida peninsula is a great centre for citrus fruits. The abundant rainfall insures the normal development of the trees without irrigation, but considerable damage is sometimes caused by the rare, but strong thermal depressions which come from the north-west. There are other citrus-growing centres in California, but there this culture is only possible with the help of irrigation.

FRUIT TREES. — The Great Lakes have a modifying effect on the surrounding districts (1) and, in numerous localities, even make it possible to grow delicate fruits, such as the peach and the grape. The principal apple orchards are found near the Great Lakes and stretch far into the maize and winter wheat belt. In the south the limit of the apple trees is the summer isotherm 26°C., in the north the winter isotherm — 10°C, and, in the west the annual isohyete of 450 mm. Only the extreme northern limit has been considered but beyond the isotherm — 6° apple-growing becomes rare. Pears are cultivated in the Great Lakes district and in the States of Maryland, Delaware, and New Jersey. In Wisconsin and Iowa the northern limit is marked by the winter isotherm — 6.5°C. In the west, pears are grown in central California and in the States of Oregon and Washington (Yakima Valley). The peach has the widest area of distribution, from the maize and winter wheat belt it goes as far north as the winter isotherm — 9°C. The peach is much more sensitive to low temperatures than the cherry and apple, and for this reason, except in the Great Lakes district, is more generally found in the maize and winter wheat belt. In the west there is a large producing centre at Fresno, in California. The southern limit of the peach is marked by the winter isotherm — 4°C.

418 - Varieties of Oats Resistant to Frost and Drought Acclimatised in Argentina. — See No. 153 of this *Review*

419 - Varieties of Maize Resistant to Drought in America and China. — See No. 115 of this *Review*

420 - *Sporobolus phleoides*, a Fodder Plant Resistant to Drought in Argentina. — See No. 160 of this *Review*

421 - Sensitiveness and Resistance of Coffee Shrubs to Low Temperature, in Indo-China. — See No. 166 of this *Review*.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

422 - Studies on the Capacity of Soils for Irrigation Water, and on a New Method for Determining Volume Weight, in the United States. — ISRAELSEN O W, in the *Journal of Agricultural Research*, Vol. XIII, No. 1, pp. 1-35 + 12 Tables + 14 Figs. + 1 Plate + Bibliography of 12 Publications. Washington, April, 1918.

From 1910 to 1915 the author studied the economic application of irrigation water to alfalfa in the Sacramento Valley, California (2). This enabled him to observe the capacity of certain soils under various condi-

(1) See *R. Feb.*, 1911, No. 152. (*Id*)

(2) See *R. May*, 1918, No. 307. (*Id*)

tions to hold the irrigation water, and to devise and test a new method for determining the apparent density of soils in the field.

I. — CAPACITY OF SOILS FOR IRRIGATION WATER. — The percentage of porous space filled by water immediately after irrigation increases with the fineness of the soil texture, this is shown by the following increasing values obtained by the author: — 40 % for silt loams with sub-soils of fine sandy loam; 51 % for silt loams, 58 % for clay loams and 66 % for clays.

The ratio between the maximum water-holding capacity determined in the laboratory (in brass tubes 12 inches long and 2 inches internal diameter filled with soil) and the maximum water-holding capacity of the soil in the field after irrigation was, on an average, 1.78 ± 0.06 for heavy soil and 1.98 ± 0.14 for average soil. In other words, in the second case, the soil crumbled and then packed in the tube retained about twice as much water as the soil in the field.

Between the maximum water-holding capacity of soil in the field after irrigation and its moisture equivalent (1) there is a sufficiently close correlation for the moisture equivalent to be used to estimate the maximum water-holding capacity of soils in the field.

II. — NEW METHOD FOR DETERMINING THE APPARENT DENSITY OF SOIL IN THE FIELD. — To determine exactly the volume of irrigation water retained by a given volume of soil in the field it is necessary to know sufficiently approximately the apparent density (or weight of the unity of volume) of the soil in the field. Laboratory methods using crumbled soil arbitrarily heaped up are useless to determine this density as they give results agreeing but little with actual facts. The use of an iron cylinder in the field containing a given volume of soil the weight of which is subsequently determined can give reliable results, but such cylinders are difficult to handle at a certain depth and the soil has to be compressed or displaced, thus falsifying the results.

To facilitate these operations the author considered it best to remove samples of the soil in the field with a slightly obconical auger (which prevents the soil from being compressed or displaced). Instead of measuring the volume of the sample of soil, he measured the *volume of the hole* corresponding to a given quantity of the soil removed which is then weighed in the laboratory after having been dried in the hot air oven. For this purpose he used thin rubber tubes closed at one end, with a diameter of $2 \frac{1}{4}$ inches and a length varying with the depth bored (a maximum of $6 \frac{1}{2}$ feet). This tube is inserted in the auger hole by means of a rounded stick and filled to the level of the soil with water from a graduated glass cylinder. The volume

(1) The moisture equivalent is the percentage of moisture retained by soil after it has been subjected to a constant strong centrifugal force and may be considered as in a state of capillary equilibrium with this force to determine this equivalent L. J. BRIGGS and J. W. MAC LANE used a centrifugal force equal to 3 000 times the gravity force. — Cf. U. S. Dept. of Agriculture, Bureau of Soils, Bull. No. 45; The Moisture Equivalents, by L. J. BRIGGS and J. W. MAC LANE, Washington, 1907. (Ed.)

of water used (after the addition of the volume of the rubber of the tube) shows the volume of the plumb hole to the depth at which the sample was taken (for example, 1 foot). When the operation is over the tube is emptied by means of a small pump, taken from the hole, and dried.

If boring has to be deeper the operation is repeated (removal of samples and measurement of the volume of the hole) for each successive depth (for example, each foot), using a longer tube each time. The volume of the last hole (say 6 ft. deep) is then determined by subtracting from the total volume (depth of 6 ft) the total of the volumes previously determined (depth of 5 ft.)

The author compared the apparent densities determined by his new method with those obtained by: — a) the iron tube method; b) Prof. C. F. SHAW's method dipping of a clod of soil in paraffin (1). He found very satisfactory agreements, the difference never being as much as 1 %.

423 — The Power of Dry or Moist Soil to Absorb Chlorine Gas. — BERTHLOT D and TRANNON R, in *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 2, pp. 121-123 + 1 Table. Paris, January, 1919.

The use of chlorine gas during the war led the author to undertake experiments to determine the absorbent powers of different varieties of dry or moist soils, firstly with respect to an almost immobile chlorine atmosphere, secondly with respect to gas currents moving at different speeds.

Ten grammes of soil were spread in a uniform layer in cylindrical evaporating dishes under a bell jar. The chlorine entered the jar through a tube entering an empty flask (so as to avoid the possibility of small drops falling into the soil), and then passed through two wash bottles, one used as a safety flask, the other as a measuring flask. After 2 hours under the jar 10 gm. of quick lime were added to each dish, so that the surface was completely covered. The chlorine was estimated by first burning the soil in the presence of the quick lime and then titrating with silver nitrate and sulphocyanide. The crude quantity obtained was corrected for the small amount of chlorine it contained previously; this had been estimated at the beginning by the same method.

The tests were made with six different soils and included three series of investigations: 1) with 10 gm. of dry soil; 2) with 10 gm. of dry soil to which 10 % of water had been added; 3) with 10 gm. of dry soil to which 20 % of water had been added. The number of centigrammes of chlorine absorbed by each soil in two hours at a temperature of 20°C and at the three different degrees of moisture are given. The conclusions drawn from these figures are:

1) White sand absorbs chlorine badly, ferruginous yellow sand absorbs it better but much less than vegetable mould.

(1) This method is described by Messrs. BROWN, MAC INTIRE and CREE in a paper entitled "Comparative Physical and Chemical Studies of Five Plots Treated Independently for Twenty-eight Years" published in the *Pennsylvania Agricultural Experiment Station, Annual Report for 1909-1910*, pp. 96-97. (Author) — A similar method, by Dr. R. TRNKA is described in *R.* October, 1911, No. 876 (Ed.).

2) Moisture hardly increases the absorbing power of sands ; the difference in the absorbing power of moist and dry sands is due principally to the absorbing power of the water in excess.

3) The absorbing power of vegetable mould is much greater than that of sand ; it is similar for all the specimens of mould and does not appear to depend on the lime content.

4) The absorbing power of moist vegetable mould is 2 to 2.5 times that of the dry soil. The increase in chlorine absorbed between dry soil and soil + 10 % of water cannot be explained by the absorbing power of the water added ; the calculations prove this. The increase in chlorine absorbed between soil + 10 % and soil + 20 % of moisture, is, however, explained by this cause. Consequently, if the initial moistening of dry soil increase the absorbent power of the soil, subsequent increase in moisture has effect only by virtue of the proportion of water it brings with it.

The moisture contents 10 % to 20 % used during these investigations are those commonly observed in vegetable moulds at a depth of a few centimetres, even in times of drought.

424 - The Chlorine Index as a Comparative Measure of the Humus Content of Soils. — LAPICQUE L. and BARBE E., in *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 2, pp 118-121 + 1 Tab'c Paris, January, 1919

The authors found that bleaching liquid, by reacting on various arable soils, loses its active chlorine in very variable proportions. The effect, which gives a measure of the oxidability of soils, is obviously connected with their humus content. In order to have at least an approximate indication of this, they devised the following method which has the advantage of being able to be carried out in the soil itself very quickly: 10 cc. of well-crumbed soil from which all stones have been carefully removed, are placed in a flask of about 150 cc. capacity with ground glass stopper; 50 cc. of bleaching liquid containing 5 to 10 volumes of chlorine are added and the flask well shaken for 1 minute. After half an hour, during which the flask is frequently shaken, it is left to stand and the remaining hypochlorite estimated. By means of a pipette 2 cc. of the top liquid are removed and placed in a 100 to 150 cc. capacity flask. 50 cc. of water are added, then 5 cc. of a 20 % potassium iodide solution; acid is added and the whole titrated with hyposulphite, using starch paste as an indicator. The same operation is re-started with 2cc. of fresh bleaching liquid. The difference between the two titrations multiplied by 2.5 gives the volume of active chlorine lost in 1 cc. of soil. If more than half the chlorine has disappeared the soil must be treated with a double volume of bleaching liquid and the figure found multiplied by 5. Normal variations of temperature, light, and the lime content of the soil have no appreciable effect on the results. All the material required for about a dozen of these tests may be carried in a light case.

Some of the results obtained by this method are given. Ploughed soils give fairly constant figures, usually varying from 15 to 20 (ratio chlorine : soil, in volumes). The sub-soils (at a depth of from 8 to 16 inches) are already much poorer in oxidisable matter, and this content diminishes a

a greater depth is reached. Forest soil gives values 2 or 3 times greater than those of ploughed land, sometimes even very close to those of mould. Peat gives 10 times the average value of ploughed land. Hill sides are much less rich than table lands or plains; this may be explained by the action of flowing water. Soil turned up to a great depth (as those exposed for a long time to cannon fire at the Front) gives very low figures.

The authors' method, which merely gives an index by which soils may be classified according to their probable humus content, may be useful in many cases, especially in estimating the condition of soil in the devastated districts to be reclaimed in some of the belligerent countries.

425 - Investigations into the Hydrogen Ion Concentration of the Soil: Effect of Chemical Fertilisers on this Concentration. See No 436 of this *Review*; **Comparison of Electrometric and Colorimetric Methods in Determining the Hydrogen Ion Concentration of Soil,** see No 536 of this *Review*

426 - The Presence of Aluminium as a Reason for the Difference in the Effect of So-Called Acid Soil on Barley and Rye. — HARTWELL B L, and PEMBER F R, in *Soil Science*, Vol VI, No 4, pp 259-277 + Bibliography of 8 Publications Baltimore, October, 1918

In field experiments made at the Rhode Island Experiment Station liming influenced the growth of rye very little but doubled, or even trebled that of barley. This seemed to show that barley is much more sensitive to soil acidity than rye. The two cereals, however, did not differ in their behaviour to acidified nutrient solutions, being almost equally affected by the acidity of the medium. The contradiction in the results of the two series of experiments much interested the authors; the difference in the behaviour of barley and of rye in the soil seemed no longer attributable to the acidity, but to another cause which the authors studied in a long series of experiments.

RESULTS. — After partial sterilisation of the soil by heat or an antiseptic the two cereals still behaved differently.

In water cultures various substances occurring in acid soils, such as dihydroxystearic acid, manure extract, and ammonium sulphate, had the same effect on both cereals, thus excluding their presence as the differentiating factor. The aqueous extract of an acid soil, however, affected barley and rye differently in the same way as the soil itself, and the ash of the extract applied in solution also had the same effect as the soil. Aluminium was found in this ash and appeared to be the substance causing the difference in the behaviour of barley and rye in the soil.

Experiments with optimum nutrient solutions showed that the addition of aluminium sulphate reduced the growth of barley almost as much as the addition of an equivalent quantity of sulphuric acid, but hardly affected the growth of rye which, like that of barley, was much depressed by the acid. Moreover, in the nutrient solution containing aluminium sulphate the hydrogen-ion concentration was four times lower than in the solution containing sulphuric acid. All these facts show the injurious effects on barley to be exercised by the aluminium, not by the acidity. This was confirmed prac-

tically by the addition of phosphoric oxide or superphosphate to the soil; the activity of the aluminium was thereby reduced, thus favouring the growth of the barley in spite of the increased acidity of the soil caused by these substances.

CONCLUSION. — Liming and phosphating soil may prove almost equally beneficial, practically by precipitating the active aluminium as, in the first case, reducing the acidity, and in the second, supplying a nutrient.

427 - **Soil Aldehydes. A Scientific Study of a New Class of Soil Constituents: Unfavourable to Crops, Their Occurrence, Properties, and Elimination in Practical Agriculture.** — SKINNER J. J., in the *Journal of the Franklin Institute*, Vol. CLXXXVI, No. 2, pp. 165-186; No. 3, pp. 289-310; No. 4, pp. 449-480; No. 5, pp. 547-584, No. 6 pp. 723-741. Philadelphia, 1918.

The author investigated the presence of aldehydes in 74 samples of soil including 14 garden soils and 60 field soils of the same type and from the same locality 30 of these were classed as unfertile and 30 as fertile. He found aldehydes in 5 of the garden soils and 12 of the field soils, most of which were unfertile. Before the author's investigations some aldehydes, especially vanillin and salicylic aldehyde, had been found in the soil. The author studied their action on the development of cultivated plants, a) in water; b) in nutrient solutions; c) in pots; d) in the field. He also studied the action of four other aldehydes: heliotropine, benzaldehyde, formaldehyde and paraformaldehyde — on water and nutrient solution cultures. These cultures, numbering 76, contained sodium nitrate, monocalcic phosphate and potassium sulphate in varying proportions.

RESULTS. — All the aldehydes tested proved injurious to water cultures even in relatively small quantities, in the following increasing order.

Vanillin: — Was more injurious to the roots than the tops, but its ill effects decreased in the presence of a large quantity of sodium nitrate.

Salicylic aldehyde. — Its harmful effect was lessened by solutions rich in mono-calcic phosphate and in the presence of calcium carbonate.

Benzaldehyde. — At the rate of 25 millionths it had an injurious effect which was not attenuated appreciably by any nutrient salt.

Heliotropine. — Was so harmful to plants that it was difficult to determine any difference in the attenuating effect of the various nutrient solutions.

Formaldehyde. — Proved equally injurious in all the nutrient solutions.

Paraformaldehyde. — Its injurious effect was equal to that of formic aldehyde, but was lessened by monocalcic phosphate.

In the pot and field experiments salicylic aldehyde and vanilline exercised no harmful effect on good productive, well-drained soils intensively cultivated, as these conditions give the soil an oxidising power which enables it gradually to eliminate the aldehydes. On the other hand, soils containing the aldehydes were not very productive and had not been kept in good conditions. This prevented the elimination of these substances, the injurious effect of which was much attenuated by the application of lime or manganese compounds. The harmful effect of salicylic aldehyde could

be controlled in such soils by mono-calcic phosphate, and that of vanillin by sodium nitrate.

CONCLUSION. -- These results show that in practical agriculture, soils rendered sterile by the presence of certain aldehydes may be made fertile by adopting methods favourable to the oxidation of these substances. These methods are, first of all the drainage and aeration of the soil, and, secondly the application of lime, manganese compounds or certain fertilisers.

428 - The Action of Various Lower Cryptogams other than Bacteria in the Soil.

I WAKEMAN S. A., The Importance of Mould Action in the Soil, in *Soil Science*, Vol. VI, No. 2, pp. 137-155 + Bibliography of 62 Publications — II WAKEMAN S. A. and CURTIS R. E., *The Occurrence of Actinomyces in the Soil*, *Ibid* Vol. VI, No. 4, pp. 309-319 + Bibliography of 25 Publications. Baltimore, 1918

I. -- MOULDS AND OTHER LOWER CRYPTOGRAMS. — Since the first micro-biological investigations into soil up to the last four or five years, the bacteria have been almost exclusively studied to the detriment of the other groups of micro-organisms of which the presence was reported now and again but nothing more. It cannot be denied, however, that the soil contains large numbers of active moulds, actinomyces, protozoa, rotifera, and, under certain conditions, algae.

The work of Russell and his collaborators on the influence of protozoa on the fertility of the soil has given rise to a series of other studies on the activity of these micro-organisms. Several workers have also studied soil algae and several papers have recently been published on the presence and probable action of actinomyces in the soil.

The author examines the metabolic processes of moulds and other lower cryptogams in the soil with a view to determining their influence on fertility. He reviews 62 publications on this subject, compares the biological activity of various lower cryptogams with that of bacteria, and discusses the most important changes of the organic and mineral matter of the soil which are attributable to the action of non-bacterial cryptogams.

Taking his own observations and those of other workers as a basis the author shows that there have been isolated from both cultivated and uncultivated soils a large number of lower, non-bacterial cryptogams, many of which it has been possible to identify. It has been possible to divide this cryptogamic flora according to the conditions under which they live. *Mucorineæ* and *Penicillium* predominate in the soil of the cold (northern) districts, whereas the soil of the warm (southern) districts contains more especially *Aspergillus*. Trichodermic algae are found in large numbers in acid soils. Many soils contain fungi of the genera *Fusarium*, *Cladosporium*, *Chaetomium*, *Alternaria*, etc.

As regards the action of these various cryptogams in the soil, it appears that the development of their mycelium causes modifications in the organic and mineral constituents, but no fixation of nitrogen or nitrification. The decomposition of organic matter by these micro-organisms, however, causes the formation of ammonia, the amount of which depends on

the sources of nitrogen and carbohydrates available ; these, in decomposing, set free carbon dioxide (1).

Nitrogenous manures applied to the soil are utilised by these cryptogams to form protein substances, at the expense of the plants cultivated which are deprived of part of the substances destined for them. This loss may, however, be largely compensated for by the fact that the soluble nitrogenous matter absorbed by the cryptogams is not absorbed by the sub-soil and when later the cryptogams are subjected to autolysis much of the nitrogen assimilated by them is returned to the soil in a soluble form and may thus be of benefit to the crops.

These cryptogams may also have a beneficial effect on the soil in virtue of their vigorous production of enzymes and acid substances which may modify the constituents of the soil in a manner favourable to the development of cultivated plants, in particular they may help to dissolve the phosphates and other minerals.

Unfortunately cryptogams capable of living parasitically on certain plants (potato, etc.) may occur in virgin soils or in soils in which these plants have never been grown, thus forming a latent danger of contamination.

II. — ACTINOMYCETES. — These include parasitic and saprophytic forms and are found in the air, water, sewage, salt lakes, milk, and certain wounds, but especially in the soil, where they form a large and important group of micro-organisms (in particular in soils rich in undecomposed organic matter), the activity of which varies with the different species.

After reviewing historically the question of soil-actinomyces, the author describes their presence and relation to the bacteria in 25 soils of North America and the Hawaii Islands. He shows that heavy soils or those rich in undecomposed organic matter generally contain more actinomyces than light soils, or those poor in such matter.

In the 25 soils examined the actinomyces represented on an average 17 % of the total cryptogamic flora (bacteria and actinomyces), whereas in an acid soil the proportion of actinomyces did not exceed 3.5 %. Many forms of actinomyces were isolated from the soils studied, including *Actinomyces chromogenus*, *A. Lipmanii*, *A. aureus* and *A. Rutgersensis* ; these were so numerous that they may be considered as species characteristic of the soil.

429 - Study on the Fixation of Nitrogen by Soil Bacteria, or "Azofication". — GRAVIER J. E., (Utah Agr. Exp. Station) in *Soil Science*, Vol. VI, No. 3, pp. 163-217. - Bibliography of 211 Publications. Baltimore, September, 1918.

The author calls "azofication" the fixation or assimilation of nitrogen in the soil by certain species of bacteria acting alone or in conjunction.

He reviews 211 papers on this subject and abstracts the principal data concerning the distribution of the nitrogen-fixing flora (especially the *Azotobacter* genus), and the conditions under which they act. He concludes that *Azotobacter* form an important factor in maintaining the nitrogen content of the soil, although their effect cannot be definitely estima-

(1) See R. Feb., 1910, No. 161. (Ed)

ted as the figures published up to the present vary greatly. Whereas HALL (Rothamsted) and the Utah Agricultural Station estimate the amount of assimilable nitrogen supplied annually to the soil by these bacteria to be 25 lb per acre, LOHNIS places it as high as 35.7 lb., and LIPMAN holds that the quantity varies from 15 to 40 lb. under favourable conditions

430 - Partial Sterilisation of Soil (1), Experiments in France. — TRUFFAUT G, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol IV, No 38, pp 1049 1057 Paris, December 4 1918

During two years the author made methodical experiments on the action of certain disinfectants used in emulsion or solution (emulsified carbon sulphide, liquid aromatic carbides, such as benzene, toluene, cumene, methyl-naphthalene, and heavy anthracenic oils used in emulsions, solid aromatic carbides, such as naphthalene, anthracene; calcium sulphide; mixtures of these bodies).

The partial sterilisation of the soil caused a remarkable increase in yield. It is easily attained and has the great advantage of supplementing a lack of nitrogenous fertilisers. It is all the more valuable in proportion as the soil is rich in organic matter and has been cultivated for a long time. It not only inhibits the development of animal and vegetable parasites, but, when the soap emulsions of certain carbides are used, greatly favours germination. The insecticidal effect of partial sterilisation may be useful in all seasons. The fertilising effect by ammonification only appears to be of real value for applications made from March to the end of April, when the period of initial depression which always follows partial sterilisation is followed by a period of advanced ammonification, and of a remarkable renewal of vegetation.

It would prove advantageous to start partially sterilising the soil 8 to 10 days before sowing or planting. The use of solid substances has always proved more satisfactory when they are lightly ploughed in. Partial sterilisation with emulsion at the end of February for fruit trees gives particularly good results. The period of delay in vegetation acts on the swelling of the fruit buds, flowering is usually delayed and this delay may save the flowers from late frosts which often do so much harm.

Under present conditions partial sterilisation of the soil appears to succeed best with mixtures of calcium sulphide, solid aromatic carbides and oily aromatic carbides (TRUFFAUT patents) (2). These mixtures are in the form of dry powders and are easily spread. Applied at the rate of 4.8 to 7.8 cwt. per acre, they give increases varying from 150 % to 250 %. It is most important that these mixtures be made with aromatic carbides and calcium sulphides free from all impurities.

(1) See the original article by F. J. RUSSELL, in *R. M. Y.*, 1917, pp. 693-702. See also *R. M. Y.*, 1917, No. 404. (Ed.)

(2) See *Review of Patents*, No. 509 of this *Review*. (Ed.)

431 - Are Unusual Precautions Necessary in Taking Soil Samples for Ordinary Bacteriological Tests? — LIPMAN, C. B., and MARTIN D. E., in *Soil Science*, Vol. VI, No. 2, pp. 131-136 Baltimore, August, 1918

When taking samples of soil for bacteriological work (1), special precautions are usually advised to keep it aseptic, such as scorching the surface of a vertical section of the soil. Is such a precaution necessary, and does it give better results than simply removing the sample with an auger? To solve this problem the authors made a bacteriological comparison of soils taken by both methods. They found in them no appreciable difference in the number of bacteria, nitrogen fixation, ammonification, or nitrification, and concluded that special precautions are useless.

During these investigations the authors observed that, in soil from arid districts, bacteria may be numerous and active at a relatively great depth. This is not the case with soils in moist districts. Although the bacteria are most numerous and most active in the surface foot of soil, yet they are sometimes almost equally so at a depth of 2 ft. Lower, at depths of 2 to 6 ft. the number and activity of the bacteria are almost uniform.

432 - Considerations on the Analysis of Forest Soils. — TAMM O., in *Meddelanden från Statens Skogsörsöksanstalt*, Pt. 13-14, pp. 225-258 + 1 Fig. + Bibliography of 36 Publications Stockholm, 1917

The author recalls the development of the chemical analysis of soil in its relations to forestry in Germany and the Scandinavian countries and mentions the work of L. MAYER, W. SCHÜTZE, P. E. MÜLLER, C. F. A. TUXEN, E. RAMANN, H. V. TIBERG, W. SCHOENBERG, and R. VOGEL VON FALCKENSTEIN. He criticises the hydrochloric acid extraction methods of analysis, and believes, like VOGEL VON FALCKENSTEIN, that they can give no reliable criterion of the productivity of the soil. Mineralogical examination and that of the state of decomposition of the soil give us more reliable data. As a rule the productivity of the soil cannot be determined by chemical analysis although it is possible by this method to determine the content in substances of great importance to forestry and to study the different processes observed in the soil.

A description is given of some of the analytical methods used at the Experimental Institute of Forestry of Sweden for analysing forest soil: 1) Complete elementary analysis; 2) determination of the different forms of nitrogen; 3) determination of calcium carbonate by treatment with dilute hydrochloric acid in vacuum; 4) determination of phosphoric acid; as for forestry work it is necessary to determine the total content, this is done by extraction with concentrated nitric acid; 5) determination of the humus by combustion; by multiplying the carbonic acid set free by 0.471 the corresponding humus content is obtained; 6) determination of the total iron content by hydrofluoric acid; 7) determination of the limonite, including a little of the soluble iron, by dissolving in mono-potassic oxalate; 8) mineralogical examination by levigation; 9) mechanical analysis by ATTERBERG's method.

(1) See R. Jan., 1919, No. 16. (Ed.)

MANURES
AND MANURING

433 - **The Effect of Liming on Crop Yields in Cylinder Experiments.** - LIPMAN, J. G. and BLAIR A. W., New Jersey Agr. Exp. Station, in *Soil Science*, Vol. VI, No. 2, pp. 157-160 + 1 Table + 1 Plate. Baltimore, August 1918

During the 20 years 1898-1918 the New Jersey Agricultural Station made, in two ten-year periods, numerous fertiliser experiments on various plants grown in five year rotation in galvanised iron tanks sunk in the earth in order to reproduce field conditions as far as possible. The objects of the experiment were — 1) to determine the denitrification of sodium nitrate applied in large and small quantities with cow manure; 2) to determine the assimilability of nitrogen supplied by sodium nitrate, ammonium sulphate, dried blood, and cow manure respectively (1).

Altogether twenty sets of experiments were made, each set including three tanks. The author's note, however, deals only with the four sets in which the following nitrogenous fertilisers were applied annually.

- 1) Sodium nitrate at the rate of 160 lb. per acre.
- 2) Sodium nitrate at the rate of 320 lb. per acre.
- 3) Ammonium sulphate in amounts equivalent to 320 lb. of sodium nitrate per acre.
- 4) Dried blood in amounts equivalent to 320 lb. of sodium nitrate per acre.

In the four sets each tank received in addition each year, superphosphate at the rate of 640 lb. per acre, and potassium chloride at the rate of 320 lb. per acre.

At the beginning of the first ten year period (1898) each tank received a large quantity of ground limestone. At the beginning of the second ten-year period (1908) the fertiliser was modified as described later.

The five-year rotation included — 1) maize, 2) oats, 3) oats; 4) wheat; 5) timothy. During both the first ten year periods (1898-18) and during the second (1908-1917) there were, therefore, two crops of maize, four crops of oats, two of wheat, and two of timothy. In addition a residual crop of oats (of millet in 1899) was cut to utilise more completely the nitrogen supplied.

At the beginning of the second ten year period (spring of 1908) the fertiliser was modified. In each of the four sets one of the tanks (A) received no limestone, a second (B) received limestone only, and a third (C) limestone and green manure of leguminosae (vetch and crimson clover). This was repeated at the beginning of the second five-year rotation of this period (1913). The objects of the modification in the fertiliser were to change the soil reaction in tank B, and to change the soil reaction and add to the nitrogen content of the soil at the expense of the atmosphere in tank C.

RESULTS. — The yield of the crop in dry matter was determined each year. During the first years it varied little in the three tanks of each set

(1) The complete report of the first 15 years is contained in *Bulletins* 221 and 288 of the New Jersey Agricultural Experiment Station. A summary of the results obtained during the 20 years was published in *Soil Science*, Vol. V, No. 4, April 1918. See R. Jan., 1919, No. 23. (F1)

and, on an average, the differences observed decreased during the ten years. During the second ten years, when the fertiliser had been modified, the differences in the yield in dry matter of the three tanks *A*, *B* and *C* of each set were already very marked in the first year (1908) and became greater later on. At the end of the second ten years the *A* tanks without limestone gave a much lower yield in dry matter than at the end of the first ten years, whereas the yield in dry matter of the *B* tanks, with limestone only, remained about the same, and that of the *C* tanks, with limestone and green manure, even increased appreciably. These results, therefore, show clearly the beneficial action of limestone, especially when applied with green manure.

CONCLUSIONS. - To increase yield by an abundant use of chemical fertilisers it is essential to apply systematically at the same time a sufficient quantity of calcareous fertiliser to modify the ill effects of the soil reaction which, sooner or later, follows the continuous use of superphosphate, sodium nitrate, potassium chloride, ammonium sulphate or dried blood in more or less large quantities. Some leguminosae must be frequently added as green manure in the rotation so as to maintain the supply of organic matter in the soil and to increase its content of assimilable nitrogen.

434 - **Action of Liming on Acid Humiferous Soil Investigations in Sweden.** - OLFV S., in *Middelländiska Statens Skogsskoleansalt* pt 13 14 pp 1257-1301 1 Fig Stockholm, 1917

The soils of unsubmerged peat-bogs require abundant lime. The action of the lime may be accounted for in different ways: 1) it may act on the microflora of the soil, 2) it may neutralise the free humic acids of the peat soil, 3) it may control the xerophytic tendency of plants growing in unsubmerged peat bogs as a result of scarcity of water which is absorbed by the humic colloids.

The author believes that the free humic acids of the soil have no injurious effect on the vegetation, but that the acid character of unlimed humiferous soil is due to the organic acids adsorbed. The composition of these acids is simpler than that of humic acid (e.g. oxalic acid) and calcium humate would prove excellent as a neutraliser. The xerophytic growth of peat bog plants is also attributable to various causes: a) lack of oxygen for the roots; b) accumulation of injurious excreta, such as oxalic acid and formic acid; c) fixation of nutrient elements by the humus, and the consecutive formation of mycorrhiza as a form of adaptation to the lack of nitrates.

The different conditions found in unsubmerged peat-bogs may be modified by liming as follows: the formation of calcium humate not only neutralises the acid toxic substances, but also sets free the fertilising elements adsorbed. On the other hand, calcium humates oxidise more easily than the corresponding humic acids, a fact of great importance. Experiments have, however, shown that liming does not affect the water supply of the plants.

A question yet remains to be solved : — can plants in peat-bogs assimilate organic substances directly, or must these substances be modified first ? However this may be, it may be admitted that the final product of such modifications is calcium nitrate, of which HESSELMANN (1) has shown the great importance for vegetation.

- 435 - **The Movement of Plant Food within the Soil.** — VAN ALSTINE E, (New Jersey Agricultural Experiment Station), in *Soil Science*, Vol VI, No 4, pp 281-308 + Bibliography of 45 Publications Baltimore, October, 1918.

The author sought to determine what becomes of the fertilising elements added to the soil and not completely removed by the crops. For this purpose samples were taken at three different depths of soils fertilised regularly for several years (Rothamsted, England, "Park" grass plots, fertilised since 1856 ; 4-year rotation plots of the Pennsylvania State College, U. S. A., fertilised since 1882 ; 5-year rotation plots of the Ohio Agricultural Experiment Station, U. S. A., fertilised for 5 years). These samples were analysed and their composition compared with that of unfertilised control plots, parallel determinations being made of the yields and composition of the respective crops produced by these different soils.

CONCLUSIONS : — *Phosphoric acid.* — This remains almost entirely where the phosphatic fertiliser is placed until removed by the crops or by erosion. Phosphoric acid in the surface layer of the soil is better utilised by plants, especially leguminosae, when alkali salts are applied.

Nitrogen. — Very little is lost by drainage during the growth of plants cultivated in well-kept land. Nitrogen added in the form of ammonium salts tends to accumulate in the surface soil.

Potassium. — In spite of the ease with which it is fixed by the soil, potassium is nevertheless subject to movement within the soil when certain salt fertilisers are used (gypsum, superphosphate, sodium nitrate, ammonium salts, etc.) and may easily be washed out of reach of the roots.

Magnesium. — Application of ammonium salts results in loss of this base

Calcium. — Its loss is due to : — 1) the loss of lime (calcium carbonate) which takes place naturally without special treatment of the soil, but is accelerated by the application of ammonium salts ; 2) the application of other alkaline salts (of potassium and sodium), ; 3) the development of acidity in the soil.

- 436 - **Effect of Chemical Fertilisers on the Hydrogen Ion Concentration of Soils.** — MORSE, F W (Massachusetts Agr. Exp. Station, Amherst,) in *The Journal of Industrial and Engineering Chemistry*, Vol X, No 2, pp 125-126. Easton, Pa., February, 1918

Most of the fertilised plots at the Massachusetts Agricultural Station have been continuously treated for 25 years. This has resulted in marked variations in their productive capacity which, in some cases, appear due to chemical and physical modification in the soil rather than to a lack of fertilisers. Amongst other investigations, the determination of the hy-

(1) See R June 1918, No 624. (Ed)

drogen-ion concentration of the aqueous extracts of the soils themselves supplied interesting data in this respect. The determinations were made colorimetrically and the P_H (1) value found varied from 4.5 to 7.

The different fertilisers used in the plots were superphosphate, sodium nitrate, potassium chloride, potassium sulphate, potassium-magnesium sulphate, ammonium sulphate, gypsum and agricultural lime. Neutral salts with strong bases and strong acids, such as sodium nitrate, potassium chloride, potassium sulphate, and calcium sulphate had little or no effect on the soil reaction in infertile soil. Superphosphate composed of a strong base combined with a rather weak acid, behaved in a similar way to the above-mentioned neutral salts. Ammonium sulphate, however, acted as a slightly ionised acid, and calcium carbonate as a slightly ionised base. The values always remained within the limits given by these two compounds.

When agricultural lime was used with other chemical manures the plots fertilised with sodium nitrate or gypsum kept the neutralising effect of the calcium carbonate longer than the plots which had received potassium salts, probably as a result of a protective effect of the lime solution in the form of bicarbonate. The application of 2 000 lb. per acre of slaked lime affects both the yield and the soil reaction for several years, but the lime finally disappears, probably as a result of leaching and transformation; the latter apparently has less effect than the former.

Below are given the comparative results obtained during one season :

Plots		P_H	Plots		P_H
2nd series	Superphosphate	5.20-6.15	1st series	Sodium nitrate	6.0
	Sodium nitrate	5.22-6.50		Ammonium sulphate	4.9
	Potassium chloride	5.25-6.15		Nitrogen-free fertiliser	5.4
	Calcium sulphate	5.00-6.65		Lime	6.0
	Calcium carbonate	6.40-7.10			
	Control	5.25-5.96			

437 - **Reverted Superphosphate.** — JAMES C. C., in *The Journal of Industrial and Engineering Chemistry*, Vol. X, No. 1, pp. 33-35 + 3 Figs. Easton, Pa., 1918.

The author made laboratory and factory experiments on the reversion of superphosphate in the preparation of complete fertiliser mixtures. He found that when superphosphate is mixed with lime or calcium carbonate the water soluble phosphoric acid decreases during storage, this decrease being accompanied by a rise in temperature which is greater with lime than with calcium carbonate. The decrease in solubility is rapid at first, and slower subsequently.

Field experiments showed that reverted superphosphate applied to sugar cane in upland, ferruginous, clay soil has an effect similar to that of soluble superphosphate; it also gives good results with rice. These results, and the preference of several farmers for reverted superphosphate, show that the product must not be condemned arbitrarily.

(1) For the definition of P_H (SORENSEN'S formula), see R. Feb. 1919, No. 150, note 1. (Ed.)

- 438 - *Butia*, a Palm with Edible Fruit for the Côte d'Azur, France. — PROSCHOWSKI R., in *La Petite Revue agricole et horticole*, Year XXV, No 572, p 13 14 Antibes, France, January 26, 1919

In view of the great confusion in the nomenclature of palms the author recalls the revision of the old genus *Cocos* made by Prof. BECCARI. Prof. BECCARI retained but one single species of *Cocos* — *C. nucifera* Z. — and made three new genera — *Arecastrum*, *Syagrus* and *Butia* — of the other species. Among the species of the *Butia* genus are palms with edible fruit which could be profitably grown along the Côte d'Azur. The palms, natives of the south of Brazil, Paraguay, Uruguay and Argentina, are very strong and resistant to drought. They are very ornamental and could be recommended for this reason only in case those with the best fruit were not obtainable. Fruit containing too much fibre to make pleasant eating raw could be utilised to make syrups.

Among the *Butia* which have borne fruit in the author's botanical garden "Les Tropiques" at Nice, the best fruit species bore fruit for the first time in 1918 and the fruit, which ripened in November, was very good. This edible fruit could certainly be improved by cultivation and selection. The tree is doubtless one of the numerous forms of *Butia capitata*, probably one of the *pulposa* variety.

The author has made an interesting botanical observation on the fertilisation of *Butia* palms. Prof. BECCARI, in his work *Genere Cocos L. e le Palme affini*, p. 42 says that the female flowers which are on a spadix can only be fertilised with the pollen brought by bees from another spadix. This opinion is based on an observation made in his own garden while *Butia capitata typica* was in flower the female flowers were ready to be fertilised only after all the male flowers of the same spadix had fallen. The author believes that the male flowers do not always bloom so early that none are left when the female flowers are ready to be fertilised. Several times he observed in his garden flowers of *Butia capitata* and varieties which produced only one inflorescence followed by an abundant production of fruit with seed. Only one tree flowered at a time and fertilisation by bees was out of the question because the authors' garden is in the country, far from any other garden containing *Butia*.

- 439 Notes on some Vegetable Globulins. I. SUMNER J. B. (Cornell University, Ithaca) The Globulins of the Jack Bean (*Canavalia ensiformis*) in *The Journal of Biological Chemistry* Vol. XXXVII No. 1 pp. 137 142 + 2 figs. — II. JOHNS C. O. LINKS A. J. and GERSDORFF C. F. I. (Bureau of Chemistry, Dept. of Agr. Washington) Distribution of the Basic Nitrogen in Coconut (*Cocos nucifera*, *Ibid.*, pp. 149 153 + 2 Tables + Bibliography of 8 Publications. Baltimore, January, 1919.

I — GLOBULINS OF THE JACK BEAN — In a paper published in 1916 (1), JONIS and JOHNS claimed to have isolated from the jack bean (or sword bean — *Canavalia ensiformis*) one albumin and two globulins, "canavalin" and "concanavalin". The author succeeded in isolating three globulins from these seeds, all three may be easily separated by means

(1) See R. I. Ch., 1917, No. 127. (*Ibid.*)

of their different degree of solubility. The first is soluble in 1 % sodium chloride and does not crystallise, this is the "canavaline" of JONAS and JOHNS. The second is soluble in a 10 % sodium chloride solution and crystallises, this the author calls "concanavalin B". The third is soluble only in concentrated sodium chloride solutions and crystallises, the author proposes to call it "concanavalin A."

II. — Copra cake, used as a food for stock, contains about 20 % of proteins, the principal one of which is a globulin. OSBORN and HARRIS in their study of the distribution of nitrogen in copra globulin, obtained the following percentages — Amide nitrogen 1.36, humin nitrogen 0.14, basic nitrogen 6.06, non-basic nitrogen 10.92.

The authors studied the distribution of the basic amino-acids in the globulin by VAN SLVKE's method and obtained the following percentages — cystin 1.44, arginin 15.92, histidin 2.42, lysin 5.80, tryptophane, present

440 - Utilisation of the Curves of the Limit of Germination of Seeds After Immersion in Solutions. — LEAGE P. in *Comptes rendus de l'Académie des Sciences*, Vol. 167 No. 27 pp. 1071-1081, Paris, December 30, 1918.

If seed of garden cress (*Lepidium sativum*) be soaked in alcoholic solutions graduated from absolute alcohol to a very dilute solution, and withdrawn successively, it is seen that, for each dilution there is a limit to the time of immersion below which the seed still germinates, and above which it no longer germinates. If the limits be represented by a system of rectangular coordinates (dilution by the abscissa and time by the ordinates) the curve of the limit of germination is obtained. Comparative tests with the seed of other plants, such as alfalfa, clover, etc., gave curves which were comparable but could not be superposed as the deviations were fairly marked. This suggested elimination and sterilisation of both the seed and the spores or eggs of the lower micro organisms always found to a certain extent on these seeds. Knowing the curve of the limits of germination when immersed in the solutions it is possible to recognise the seed least resistant to the solutions, how to eliminate them and sterilise the seed required. For example, by comparing the curves of garden cress and alfalfa it is seen that, in a 78° alcohol solution the time limit is one day for cress and over eight days for alfalfa. The cress seed can, therefore, be eliminated. By comparing the curve of dodder with that of other seed it will be seen whether it is possible, by the same method, to eliminate this parasite from a mixture of seed of equal size difficult to separate by sifting.

If it be too expensive to use alcohol, salt solutions, especially sodium chloride may be tried with advantage, as the curve for cress obtained by the author with these solutions was of the same shape. Moreover, not only intact seeds are capable of retaining their vitality for some time in media which on first thoughts would be considered fatal, seed which has germinated for 1, 2, or 3 days and has been put, first in alcohol solutions, then in fresh water, may start growing again. Certain cuttings can remain in 94° alcohol for 2, 6, 12, and 24 hours and still retain their activity.

441 - **Do Seedlings Reduce Nitrates?** — DAVIDSON, J. in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 1, pl. 143-148 + 1 Table Baltimore, January, 1919.

In continuation of LAURENT's experiments on the reduction of nitrates by plants (*Annales de l'Institut Pasteur* p. 722, 1890) repeated by SCHREINER and SULLIVAN (*U. S. Department of Agriculture, Bureau of Soils, Bulletin* 73. Washington, 1910) (1), the author studied the economy of nitrogen in vegetable organisms with the aim of ascertaining whether the seedlings contain certain elements of the nature of reductases, capable of transforming nitrates into nitrites.

Wheat seedlings (1 to 2 days old) were placed on floating wire-netting discs in contact with a sodium nitrate solution the nitrate content of which was determined colorimetrically every 24 hours. The results obtained showed that the amount of nitrites present varied from day to day without any regularity, rising and falling intermittently; this may be explained by the general and complex biological process, simultaneous reduction and oxidation, bacterial activity, etc. The author repeated the experiment, but this time a certain number of seedlings were separated from the seed and placed separately in contact with the sodium nitrate to which a little toluene had been added as an antiseptic. The qualitative determination of the nitrites made at the end of 24 hours showed there to be an appreciable quantity in the solutions placed in contact with the whole seedlings (with seed) and the seeds without plants, but none was found in the solutions in contact with the seedlings without seed. The author naturally concluded that the seat of the reducing elements in wheat seedlings is exclusively in the parent seed attached to the plant. A later experiment, however, showed the production of nitrous nitrogen to be caused by bacterial activity. When the preceding experiment was repeated under aseptic conditions (sterilisation of seed and material) no formation of nitrous nitrogen was observed in any case.

To determine whether the toluene prevented the formation of nitrites in the solutions in contact with seedlings separated from the seed the author placed whole wheat seedlings in contact with the same solutions, arranging them so as to avoid all contact between the solution and the seed, but taking no special precautions to avoid bacterial contamination. Under these conditions, even after a week, only negligible traces of nitrites were found.

The most rational explanation of this phenomenon is that the reducing micro-organisms were unable to develop in the solution because the rootlets did not supply them with sufficient food. At any rate the last experiment shows clearly that wheat seedlings do not reduce nitrates to nitrites.

Complementary investigations made with maize, barley, oats, etc. lead to the same general conclusion. The metabolism of the seedlings does not necessitate the reduction of nitrates in their culture medium.

(1) See *R. Jan*, 1911, No. 60. (Ed.)

- 442 - **Comparative Water Requirements of Different Varieties of Oats: Investigations in Germany.** — VON SEELHORST C., in the *Journal für Landwirtschaft*, Vol. LXVI, Pt 2, pp 121-127 + 3 Tables. Berlin, June, 1918.

To determine the water requirement of different varieties of oats (Petkuser, Göttinger, Strubes, and Lüneburger Klay) they were grown at Göttingen in plots with different moisture contents.

RESULTS. — On the whole the yield of the different varieties was in proportion to the moisture content of the soil, but differed with the varieties. At all degrees of moisture the yield of Petkuser was below that of the other varieties. The Lüneburger Klay variety held first place at a moisture content of 50.63 and 76 %, but at 80 % its yield was exceeded by that of the Strubes and Göttinger varieties. When the moisture content of the soil was highest the Strubes variety gave the best yield.

The absolute consumption of water (including that removed by evaporation) for the four varieties increased greatly with the moisture content of the soil; it was lowest for the Petkuser variety and highest for the Lüneburger Klay and Strubes varieties.

The relative consumption of water removed by the plant (exclusively) decreased for the four varieties with the increase in the moisture content of the soil up to 76 %; above this value it increased greatly. In this connection the behaviour of the four varieties varied with the moisture content of the soil. When this content was 50 % the Petkuser variety consumed the greatest relative amount of water, at 63 % the Strubes variety, and at 76 % the Lüneburger Klay variety. When the moisture content of the soil was at its maximum the Petkuser variety again consumed the greatest quantity of water.

- 443 - **Natural Crossing in Wheat in the United States.** HAYES H. K., in *The Journal of Heredity*, Vol. IX No. 7, pp 326-330 + 2 Figs. Washington, November, 1918.

PLANT
BREEDING

There is a certain disagreement among workers as to the possibility and frequency of natural crossing in wheat. According to ROBBINS it is normal in the *durum* types in hot, dry countries (as in certain parts of India), whereas self-pollination is the rule in the northern, wet countries. On the other hand, KORNICKE considers self-fertilisation to be predominant in the species *Triticum vulgare*, *T. durum*, *T. dicoccum* and *T. Spelta*, but admits that natural crossing is possible.

The paper under review gives the results of experiments which confirm the possibility of spontaneous crossing in *Triticum vulgare*. The varieties studied were Marquis and Bluestem (beardless), Arnautka, Kubanka, and Turkey (bearded).

By crossing a beardless with a bearded variety partially bearded F_1 hybrids were obtained, i. e., the awns were only partially developed on the upper part of the ear only. The F_2 was composed of beardless, intermediate (hybrid), and bearded plants in the ratio 1 : 2 : 1. By crossing the hairy chaffed Bluestem variety with the smooth-chaffed Marquis variety was obtained an F_1 composed entirely of hairy-chaffed plants, and an F_2 including plants with both hairy and smooth chaff in the ratio 3 : 1.

These results seem to show that the appearance of bearded and hairy chaff in plots sown with a beardless, smooth-chaffed wheat of certain purity and origin may be considered as a sign of spontaneous crossing. To verify this hypothesis a series of observations were made in 1917 on plots of various wheats, with the following results.

MARQUIS VARIETY (bearded and smooth): -- of 320 plants, 2 had beardless and hairy ears, and 1 had intermediate characters; this proportion corresponds to 0.9 % of spontaneous crossing.

VARIOUS BEARDLESS VARIETIES (beardless and smooth): -- of 80 plants, 1 had hairy glumes -- 1.3 % spontaneous crossing.

PRESTON VARIETY (bearded and smooth): -- of 160 plants, 1 had fairly developed ears and partly pubescent glumes -- 0.6 % of spontaneous crossing.

HYBRID TURKEY \times WELL (bearded and smooth): -- of 320 plants, 6 with intermediate characters -- 1.9 % of spontaneous crossing.

Triticum durum and *T. Spelta* - no case of spontaneous staurogamy.

In all the varieties of *Triticum vulgare* together an average of 1.3% of crosses was found. Admitting that crossing occurred to the same extent between plants of the same variety, the total double percentage, 2.6 % would be obtained. This would make it possible to admit that in *Triticum vulgare* spontaneous crossing may occur at the rate of 2 to 3 %. This would easily explain the phenomena hitherto attributed to mutation or reversion.

444 - The Inheritance of Hull lessness in Oat Hybrids. - LOVER H H, McROSTIE, G P in *The American Naturalist*, Vol LIII, No 624, pp 532 + 7 Figs. Lancaster, Pa., January February, 1919

The results are given of a series of reciprocal crosses between hull-less and hulled oats made to study the behaviour of these two grain characters in the hybrids. The first belonged to the *Avena nuda* group, the second to the *Avena sativa* variety, except in one case when *Avena fatua* was used.

1ST GENERATION (F_1). - The characters of the hybrids were intermediate to those of the parents, i. e. hull-less and hulled grain occurred on the same panicle and sometimes on the same spikelet.

2ND GENERATION (F_2). The F_2 contained plants with hulled grain, intermediate grain, and hull less grain in the ratio 1 : 2 : 1. This seemed to show the presence or absence of glumelles to be due to a single factor. Thus, for example, the F_2 of the cross *Avena nuda* \times Black Tartarian contained 37 hulled plants, 85 intermediate ones, and 37 hull-less ones. In the F_2 of the cross Danish Island \times *Avena nuda* the number of plants was 115, 216 and 114 respectively.

The plants with intermediate grain (heterozygous) showed all the stages between forms with almost all hull less grain (i. e. with a very small percentage of hulled grain), and those with almost all hulled grain (i. e. a very high percentage of hulled grain). This is shown in the following ta-

(1) Similar investigations made in England by Mr ST CLAIR CAPORN were described in *R. Nov.*, 1918, No 1226 (Fd)

ble which shows the number of heterozygous plants in the F_2 . The percentage of grain is shown at the top of the column; —

Cross	Percentage of hulled grain																			
	2.5	7.5	12.5	17.5	22.5	27.5	32.5	37.5	42.5	47.5	52.5	57.5	62.5	67.5	72.5	77.5	82.5	87.5	92.5	97.5
<i>Avena nuda</i> × <i>A. fatua</i> . .	—	2	3	5	4	4	3	4	4	7	5	5	8	4	6	5	7	10	13	15
<i>Avena nuda</i> × Swedish Se- lect	10	4	4	3	5	8	2	1	7	6	3	4	2	5	3	3	6	3	4	6
<i>Avena nuda</i> × Sixty Day	5	5	5	4	4	6	6	8	20	15	22	21	15	13	17	11	7	4	4	1

3RD GENERATION (F_3) — Between the percentages of hulled grain in the F_2 heterozygous plants and their F_3 descendants there was a strong correlation expressed by the indices 0.206 ± 0.039 , 0.623 ± 0.025 , and 0.741 ± 0.024 in the three cases studied by the author respectively. Consequently if seed of an F_2 plant with a very low percentage of hulled seed (for example 2.5 %) be sown, the F_3 obtained will be composed of $1/4$ plants with hulled grain, $1/4$ plants with hull-less grain, and $2/4$ plants with intermediate grain, a large majority of which would have a low percentage of hulled grain. In the same way, if seed of an F_2 plant with a very high percentage of hulled grain (for example 85 %) be sown, the F_3 will be composed according to the same segregation ratio as in the previous case, but the great majority of the heterozygous plants will contain a high percentage of hulled grain.

Percentage of hulled grain in the F_2 zygous plants	Number of F_3 descendants		
	Hulled grain	heterozygous grain	hull-less
9.5	10	31	14
14.0	1	20	7
17.0	4	9	0
17.2	22	13	24
23.2	15	36	11
23.0	15	21	20
<i>True ratio</i>	76	173	88
77.0	28	32	22
79.7	16	27	22
80.0	8	31	19
81.7	13	27	13
87.9	19	32	17
<i>True ratio</i>	84	155	93

Thus, whatever may be the percentage of hulled grain in the F_2 hetero-

rozygous plants, the theoretical segregation ratio of their F_2 descendants will always be the same viz. $\frac{1}{4}$ plants with hull-less grain, $\frac{3}{4}$ heterozygous plants and $\frac{1}{4}$ plants with hulled grain. This is shown by the annexed table (p. 401) which gives the number of F_2 plants with hull-less heterozygous and hulled grain respectively opposite the percentages of hulled grain in the F_2 heterozygous plants :

CONCLUSIONS. — In the crosses between oats with hull-less grain and oats with hulled grain the grain characters are transmitted in accordance with the simple Mendelian ratio : 1 with hulled grain : 2 with heterozygous grain : 1 with hull-less grain. This is in agreement with the results previously obtained by NORTON, GAINES, ZINN and SURFACE etc.

The plants with heterozygous grain show all the stages between a very low percentage (2.5 %) and a very high percentage (97.5 %) of hulled grain.

There is a marked correlation between the percentage of hulled grain in the F_2 heterozygous plants and its heterozygous descendants in the F_3 .

Whatever be the percentage of hulled grain in the heterozygous plants of the F_2 , the theoretical segregation ratio between their descendants in the F_3 is always 1 : 2 : 1.

445 - Material for the Improvement of Maize by Crossing and Selection, in America.

-- COLLINS G. N., in *The Journal of Heredity*, Vol. 9, No. 4, pp. 247-251 + 3 Figs. Washington, April 1918

MATERIAL FOR THE IMPROVEMENT OF MAIZE. The area of distribution of maize cultivated in America from New England to Argentina and Chile, under the most varied climate and soil conditions, makes it seem probable that a large number of well differentiated types of maize exist. The utilisation of this rich material in selection and hybridisation work has barely begun, and there is no doubt that numerous varieties unknown to the selector are cultivated by the natives of tropical America. Many of these, though far inferior to the European and North American types in development and productivity, have special characters of adaptation and resistance which could be utilised by hybridisation and selection to improve the best cultivated varieties and to "make them" more resistant to drought, cold, etc.

DESCRIPTION OF SOME VARIETIES CULTIVATED BY THE INDIANS OF CENTRAL AMERICA. — The first place among these varieties is taken by "Hopi" maize, grown by the Hopi, Navajo, and Zuni tribes. It is characterised by the presence of a single root and the development of the mesocotyl, which may reach a length of 36 cm. whereas in the commercial varieties it is never more than 10 cm long. At the time of sowing the Indians dig holes 6 to 18 inches deep in the soil, which is almost arid at the surface, thus reaching the wet beds of the sub-soil, in which they place the seed which they then cover with soil. Sown so deep the commercial varieties of maize could not develop because their mesocotyl is not more than 10 cm. long. In the Hopi maize, however, the mesocotyl pierces the layer of earth covering the seed, thus making it possible for the leaves to open and develop normally. Moreover, the single terminal root develops strongly and penetrates the earth to a great depth without

losing contact with the wet layer. The water supply of the plant is thus favoured by the exceptional development of the mesocotyl and root which between them use the water reserves of the soil to the best advantage. It is an ideal maize for the wind-swept plains of New Mexico and Arizona where rain is rare. As the rain falls especially in winter, the soil is already completely dry on the surface when the weather is sufficiently warm for sowing. The summer rain comes very late, in June and July, and cannot be used for late sowing as the unripe plants would be exposed to the first autumn frosts of September. Under such conditions only Hopi maize can be successfully sown because the seed can be placed in deep holes in contact with the layers where the rain fallen in winter is stored. At San Diego, California, in 1917, Hopi maize ripened normally without receiving one drop of water throughout the vegetative period. These valuable characters of Hopi could certainly be successfully utilised in hybridisation and selection.

Zea hirta is another type of maize characterised by the presence of hairs on the leaf sheath and also, partly, on the blades. It grows in the Mexican plains, where water is very scarce. Acclimatisation tests in the semi-arid districts of the west of the United States gave completely negative results, contrary to all expectation. A more careful study of the structure and form of the plant showed the cause of this failure :— Instead of growing downwards the roots of *Zea hirta* grow horizontally, in the upper layer of the soil almost in contact with the air. This enables it to utilise the small quantities of moisture which come to it during its vegetative period in the form of mists and light rain which cannot penetrate far into the soil. In the semi-arid districts of the west the rain falls in winter instead of during the vegetative period, so that plants must obtain their water from the reserves stored at a certain depth, thus making desirable a root system well-developed vertically. Under such conditions *Zea hirta*, the roots of which do not go deeper than 6 inches can, naturally, not live.

Conditions similar to those in Mexico are found in other parts of tropical America where this special form of adaptation to an environment poor in water could be advantageously utilised.

Another appreciable characteristic of *Zea hirta* is that it grows at relatively low temperatures at which the ordinary varieties of maize can neither develop nor ripen. In creating forms for countries where the average temperature is below the thermal optimum for maize this variety should form excellent material for crosses.

Each district may be said to possess valuable forms of adaptation. From Bolivia come varieties capable of keeping their stalks and leaves green a long time after the ears are completely ripe. Mexico has a type capable of withstanding very high temperatures, China one that can safely withstand hot, dry winds at the period of flowering, etc. -

COMBINATION OF CHARACTERS. - - Most of the characters of maize are transmitted independently of each other, so that by crossing it is possible to obtain the most varied combinations. Agricultural geographical

work must be so organised that interesting forms of adaptation, unknown or unused at the present time, may be utilised by all institutes and stations interested in the improvement of maize. It would, therefore, be well to make a general census of maize together with a detailed study of the particular climatic and agro-geological conditions. Such a study would make it possible to determine the signification and true value of the different forms of adaptation. It is not enough to know that a variety can do well in spite of unfavourable climatic conditions, it is necessary also to know the behaviour of the plant under these adverse conditions. Hopi maize and *Zea hirta* resist drought, or rather can flourish even where the total precipitation is very low, but these two forms of adaptation and, consequently, their geographical distribution, are very different. Hopi maize resists because it can obtain the water stored during winter at a great depth; *Zea hirta* resists because, during its vegetative period, it can utilise the mist and light rains which do not penetrate far into the soil. If this type were utilised to create maize for the semi-arid districts of the West, the results would, obviously, be negative.

In looking for new varieties the aim should not be to find varieties ready for market but to look for certain determined characters of resistance which later, by means of crosses, can be transmitted to the best commercial varieties. The valuable characters and forms are often found in plants of unattractive appearance and rather weak development. The appearance of a plant on the whole is less flourishing in proportion as the environmental conditions are unfavourable and extreme, and the characters of adaptation which enable the plant to withstand unfavourable climatic conditions are all the more distinct and well-developed.

446 - **Mass Mutation in Maize.** — DE VRIES II, in *Science*, N. S., Vol. XLVII, No. 1219, pp. 465-467. Garrison-on Hudson, N. Y. 1918.

The mutation mentioned in this paper has already been described under the name of *Zea Mays* mut. *sterilis*, in Vol. 1 of the *Botanisch Jaarboek der Dodonaea's Maatschappij van Gent* (Botanical Yearbook of the Dodonaea Society of Ghent). It is characterised by the absence of ramifications which reduces the plant to a single straight stalk having no ears nor male flowers. It resembles the branchless pine described by SCHROETER. The conditions under which this mutation occurred were as follows:—The author had cultivated during six successive years a pure strain of common maize, taking all the precautions necessary to prevent staurogamy and had noticed nothing abnormal. In the 7th generation, composed of 340 plants, there suddenly appeared 40 with the mutation described the percentage of which (12 %) greatly exceeded that usually observed in *Linaria*, *Chrysanthemum*, and *Oenothera* plants (1 to 2 %). In addition to these 40 completely sterile plants there were some intermediate ones with incompletely developed male and female flowers. The author chose one of these plants for propagation and, the following year, obtained 57 plants, 11 of which belonged to the sterile type. The percentage of mu-

tation had thus risen to 19 %, giving a new, distinct proof of the possibility of mass mutation.

To explain the sudden appearance of so large a number of abnormal forms, Bartlett admits that fundamental mutation is produced only in one of the two gametes of the generation *A* preceding the generation *B* in which the mass mutation occurs. In the *A* generation the action of the modified gamete is hidden by the dominant action of the other gametes. Segregation appears in the generation following *B* and is in a way analogous to segregation of characters in the Mendelian sense, except that MENDEL'S law concerns the hybrids between different species or varieties, whereas, in this case, scission occurs within a pure strain. The law of probability may be applied in both cases, but the starting points are different. Mutational segregation is connected with the appearance of a new character, whereas Mendelian segregation implies the pre-existence of all the characters concerned.

It is generally admitted that mutation is produced during the formation of the gametes some time before fertilisation, probably during synapsis. The combination of two mutant gametes is, therefore, rare; that of a mutant gamete with a normal one is much more frequent. The first gives rise to complete mutation, of which the best example is the so-called *gigas* (giant) types with a double number of chromosomes found in some species of *Oenothera*. The plants resulting from the combination of a mutant gamete with a normal gamete may be called half mutants. In nature, where mutations are very rare, there is little chance of the occurrence of complete mutants (by the combination of two mutant gametes). As a rule half mutants occur first, then, in the following generation, mass mutation, according to BARTLETT'S theory.

In the case of *Zea Mays* mut. *sterilis* it may be said that one gamete of the 5th generation mutated and combined with one normal gamete, thus producing in the 6th generation an intermediate or half mutant form difficult to distinguish. In the 7th generation this gave rise to mass mutation.

- 447 The Existence of Five Genetic Factors Affecting the Length of the Stalk in the Pea. — WHITE O. P., in *The Brooklyn Institute of Arts and Sciences, Brooklyn Botanic Garden, Contribution No. 20* (Reprinted from, *Memoirs of the Torrey Botanical Club*, Vol. 17, pp. 316-322 + 1 Fig. + Bibliography of 12 Publications Brooklyn, 1918)

With respect to length of stalk, MENDEL divided the varieties of *Pisum sativum* into two groups "long" and "dwarf". By crossing these two types he obtained an F_1 composed of plants as long as, or even longer than the long parent, and an F_2 composed of long and short plants in the ratio 3:1. According to him these results showed the difference between the two groups to be due to one factor. Subsequent investigations made by BATESON, KEEBLE and PELLEW, LOCK etc., showed that, in some cases, the inheritance of length of stalk is much more complex than MENDEL admitted. By the use of biometrical data collected

from 200 varieties of *Prism sativum*, the author was able to distinguish 3 classes. -

A) Long types (over 1 1/2 ft)	{	I - With 20-30 internodes (Ex, Mummut, Goldkoning White Tye'd Marrowfat)
		II - With 40-60 internodes (Ex, Scotch Beauty, Spate Gold)
		III - With 20-30 internodes (Ex, Grum Riesen S habbel)
B) Semi dwarf types	{	IV - With 10-20 long internodes (Ex, Velocity, First of All, Express)
		V - Stalk of intermediate length, with short internodes as in the dwarf type
C) Dwarf type (less than 1 ft)	{	VI - With 10-20 short internodes (Ex, Laxtonian, Nott's Excelsior)

Crossing experiments with these different types gave complex results which can only be explained by admitting the existence of at least 5 genetic factors, two of which determine the length of the internodes and three the number of internodes. Below are given these factors together with their symbols and opposite the symbols describing the absence of the two principal factors.

Genetic factors of length:

L	long internodes
L_r	very long internodes
T	20-40 internode
T_r	40-60 internodes
T₂	20-30 internodes

Absence of the two principal factors:

l	short internodes
t	= 10-20 internodes

With the help of these genetic factors the gametic composition of the different types may be represented as follows

1) long types	I - With 20-30 internodes	L T.
	II - With 40-60 long internodes	L T_r
	III - With 20-30 very long internode	L_r T.
B) Semi dwarf types	IV - With 10-20 long internodes	= L T.
	V - With 20-40 short internodes	= l T.
C) Dwarf type	{ VI - With 10-20 short internodes	= l t.

The cross I × IV gave an F₁ composed of long plants with long internodes, and an F₂ including both long plants and semi-dwarf plants with long internodes

The cross I × V gave, in F₁ long plants with long internodes, and, in F₂, long plants with long internodes and semi dwarf plants with short internodes, in the ratio 3:1

The cross I × VI, gave, in F₁, long plants with long internodes, and in F₂, long plants with long internodes, semi-dwarf plants with long internodes, semi dwarf plants with short internodes, and one dwarf plant, in the ratio 9:3:3:1, showing di-hybridism.

The cross between the two semi-dwarf types IV and V gave, in F_1 long plants with long internodes, and, in F_2 , the same results as those obtained in the F_2 of the cross I \times VI.

The cross between the semi-dwarf type IV and the dwarf type VI, gave in F_1 , semi-dwarf plants with long internodes and, in F_2 , semi-dwarf plants and one dwarf plant in the ratio 3 : 1.

The genetic factors proposed by the author make it possible to explain simply and clearly the numerous cases studied by him.

448 - Inheritance of Productivity in Potatoes in Connection with the Choice of Tubers for Planting; Investigations in Germany. VON SLIMHORST C., in *Journal für Landwirtschaft*, Vol. LXVI pp. 141-162, Pt. 3 - Berlin, November 12, 1918.

In continuation of previous work on inheritance in the potato the author sought to determine whether the characters, number and size of tubers in the parent plant are transmitted to their descendants, thus influencing their productivity. For this purpose he collected, in 1916, and weighed separately the underground parts of numerous productive and slightly productive plants of five varieties, Belladonna, Deodara, Industrie, Helios and Gratiola. These he divided into two classes:—

A) Producing many tubers: an average of 11.6 per plant, weighing 760 gm. together.

B) Producing few tubers: an average of 5.2 per plant, weighing 357 gm. together.

To determine the influence of the size (weight) of the tubers on the productivity of their descendants the tubers of each of these two classes were sub divided into four groups according to weight:—over 100 gm., 100 to 70 gm.; 70 to 50 gm.; less than 50 gm. Each group was planted separately and the respective yields in tubers of the descendants determined. The average yield per plant in the descendants of the largest tubers (over 100 gm) and of the smallest (less than 50 gm.) of each of the two classes is given in the following table together with the average weights of the parent tubers:—

Parent plants		Descendants	
B) Producing many tubers	1) Big, average weight 139 gm	730 gm of tubers per plant	
	2) Small, average weight 33 gm	519 gm	" " " "
A) Producing few tubers	3) Big average weight 137 gm	576 gm	" " " "
	4) Small, average weight 33 gm	374 gm	

Between groups 1 and 2 the difference in yield of the descendants per acre is 7514 lb., and between groups 3 and 4, 7134 lb.

CONCLUSIONS. — The differences in yield show that the size of the tubers used for planting has a decided influence on the yield of the descendants, the large tubers being usually more productive than the small ones. The influence of the size of the tubers may, however, be surpassed by that of the productivity (number of tubers) of the parent plants, because, in the

tests, small tubers from productive parent plants nearly always gave more productive descendants than those of large tubers from slightly productive plants. For example, whereas the smallest tubers (average weight 33 gm) of productive plants had descendants yielding, on an average, 519 gm. of tubers per plant, the relatively large tubers (average weight 84 gm.) of slightly productive plants had descendants producing only an average of not more than 488 gm. of tubers per plant.

These results are very important in choosing tubers for planting. If ultra selected varieties are used the tubers may be taken from the crop without special choice. In other cases they should be taken only from productive plants if high yields are desired.

The yield in tubers of a potato crop, expressed by a multiple of the weight of the tubers planted, is higher in proportion as the seed potatoes are smaller. This is shown by the following example in which the yields in tubers obtained by planting equal weights of different sized seed potatoes are compared.

Size (weight) of seed potatoes	Yield in tubers expressed by a multiple of the total weight of the seed potatoes used
Over 100 gm	5.2 times the total weight of seed potatoes used
From 100 to 70 gm	7.9 " " " " " " " "
From 70 to 50 gm	10.0 " " " " " " " "
Less than 50 gm	15.7 " " " " " " " "

It is, therefore, doubtful whether also sowing small tubers closely is not as advantageous as sowing large tubers far apart.

449 - Some Studies in Blossom Colour Inheritance in Tobacco, in the United States.

- ATTARD H. A., in *The American Naturalist*, Vol. LIII, No. 621, pp. 79-84, Lancaster, Pa. January-February 1910.

This paper describes crosses between varieties of tobacco with white, pink and carmine coloured flowers respectively, made to study the colour inheritance in the flowers of the descendants. The tobaccos used were:—

With white flowers:— *Nicotiana sylvestris*, *N. Tabacum* S. P. I. No. 30887 from Honduras.

With pink flowers:— Connecticut Broadleaf, 70 leaf Cuban, Maryland Mammoth.

With carmine flowers:— Variety grown as an ornamental plant and sold under the name of Giant Red Flowering Tobacco.

The cross *pink* ♂ × *carmine* ♂ (as well as the reciprocal cross) gave an F₁ composed exclusively of plants with carmine flowers and an F₂ containing plants with carmine flowers and plants with pink flowers in the ratio 211:71, corresponding to the theoretical ratio 3:1.

In the crosses between types with *pink* flowers or those with *carmine* flowers with types with *white* flowers, white behaved as a recessive character so that in F₁ the plants had exclusively pink or carmine flowers, and in F₂ 1/4 of the plants had white flowers.

- 450 — Selection of Thornless Varieties of Washington Navel Orange, in the United States.** — SHAMLL A D, and POMEROY C S, in *The Journal of Heredity*, Vol IX, No 7, pp 315 317 + 2 Figs. Washington November 1918

The thorns of the Washington Navel Orange (*Citrus sinensis* [L.] Osbeck) are modified branches which sometimes show their origin by producing flowers and leaves at their extremities.

The production of thorns is a hereditary character which it would be well to suppress gradually by the continual selection of scions, taking them from the plants with the fewest thorns. The results so far obtained show that, by thus selecting the scions, entirely thornless types of *Citrus sinensis* may be isolated.

- 451 — Lemon Orchard from Buds of a Single Selected Tree, in California.** — SHAMLL A D, in *The Journal of Heredity*, Vol IX, No 7, pp. 319 320 + 2 Figs. Washington, November, 1918

All the Lisbon lemon trees, 1700 in number, grown in the Shippey grove (4 miles north of Porterville, California) were grafted with buds from the same tree, grown in the Buswell grove, near Porterville, and distinguished by its high yield and the uniformity of its fruit.

In the Lisbon plantations, where the grafting material is not selected, the number of aberrant plants is from 10 to 70%, whereas in the Shippey grove such varying types have never occurred. The uniformity and productivity of this grove are an example of the good results obtained by a suitable choice of grafting material.

- 452 — Observations on Some Wheats Sown in Spring in France** — VITCOQ A, in the *Comptes rendus des Seances de l'Académie d'Agriculture de France*, Vol V No 7, pp 223 227. Paris, February 19, 1919

The author gives the results of his observations on Manitoba, Aurora (1), Little John, and Victor spring wheats. Little John, distinguished by its small growth, is the result of a cross made by Prof. BIFFIN at Cambridge between the Hindoo wheat Glinka, and Square Head Master. It has great tillering powers, is rich in gluten, and is very popular in England, where it is much appreciated as a winter wheat. Victor wheat was obtained by GARTON in England, where, as a white wheat, it has given very high yields.

The four wheats were sown at Chesnoy on March 26, 1918, in soil as homogeneous and as well prepared as possible forming part of the sand and gravel of the terraces. The land was first given 180 lb. of superphosphate, and later, in April, 110 lb. of sodium nitrate over the growing plants.

From the first month the author noticed a difference between the four wheats tested which, with regard to growth and vigour, came in the following order: — Aurora, Manitoba Victor and Little John. The first two accomplished their vegetative cycle normally and were ready for harvesting on August 12. The other two only eared in August and could not be harvested till September 14. The yields in grain per acre were: Little John 151 lb., Victor 183 lb., Manitoba 811 lb., and Aurora 1407 lb. The yields of Little John and Victor were absurd, about the amount of seed sown. The

yields of the other two were not very high, but the exceptional drought of 1918 which had a disastrous effect on the calcareous soils of the district must be borne in mind.

In reality the Little John and Victor varieties must be considered as winter wheats (1). They are much too late to be recommended unreservedly in Central France. Manitoba should give way to Aurora, the superiority of which is undoubted and the yields of which can compete with those of some of the good winter varieties.

453 - Comparative Cultural Tests with Varieties of Wheat, Rye, and Oats, at Forus, Norway. — HONNINGSTAD, A. in *Auswertung anvaand de off. nllige foranstaltninger til landbrugets fremme i aaret, 1917*, pp. 523-542. Christiania, 1918.

This paper gives the results of comparative cultural tests made from 1912 to 1917 in the neighbourhood of the Agricultural Station of Forus, Norway.

Wheat. -- The wheats examined may be divided into two groups: native Norwegian wheats (Börsum, Lerdal, Oestby, Maessel, and Smeböl), and American wheats (Red Fife, Blue Stem and Marquis).

Native Norwegian wheats. — Börsum wheat is a native of Börsum, in Aas (Akershus district). During the six years of the test it gave an average of 2 362 lb. of grain and 5 286 lb. of straw per acre. Its stem is relatively short and very strong, its leaves small, ears not very large, glumes usually brownish, and either beardless or ending in slightly developed awns. Plants are however, also found with light ears (yellowish white), some of which have downy glumes. The colour of the grain is not very uniform but the light brown, the "red" of selectors, predominates. The average weight of one grain is small (31 mgm).

Lerdal wheat, a native of Jarlsberg, takes its name from Lerdal, a locality in the Akershus district. In the comparative tests it produced 2 % less straw and 3 % less grain than Börsum wheat, which it resembles greatly. Its grain is very small, weighing only 29 mgm. on an average.

Oestby wheat, a native of Tjølling, in the Jarlsberg district, produces as much grain as Börsum wheat, but a little less straw. It has dark brown glumes, strong awns, and brown grain, heavier than that of the other Norwegian varieties (average weight 35 mgm). and is very uniform in size and weight.

Maessel wheat, a native of Froland, in the Nedenes district yielded 1 % more grain and 1 % less straw than Börsum. It closely resembles Börsum and Lerdal, from which it differs only by somewhat paler glumes and grain and rather more compact grain.

Smeböl wheat from Aas has only been tested one year. It is, therefore, difficult to give any precise opinion on it.

In conclusion it may be said that the four native varieties tested are of equal value and form good elements especially adapted to the soil and climatic conditions.

American wheats. — Red Fife and Blue Stem wheats, so largely grown in the United States, did not give good results in Norway, where they proved inferior to the native types. They require a warmer summer.

(1) See R. Much, 1910, No. 303 (Fd)

Marquis wheat from Canada also gave bad results both as regards the quantity and the quality of the product. In any case, American wheats are less early than the Norwegian ones.

SPRING RYE. — Two varieties were tested, one Norwegian and one Swedish. The second has only been tested for one year, but there is no reason to prefer it to the Norwegian type, Lunderöd, a native of Oiestadt, in the Nedenes district.

The average general grain yield of Lunderöd rye exceeds that of Börsum wheat by 9 %. This result would justify wider cultivation of this cereal, especially in the more sunny districts and arid soils.

OATS. — Of the oats tested the German variety Strübes Schlanstedter did best with a grain yield of 133 % and a straw yield of 120 % as compared with the respective yields of Börsum wheat, equal to 100. Nevertheless this variety is too late as compared with the Norwegian and Swedish types.

Guldregn follows next with 131 % of grain (always as compared with Börsum wheat). The percentage of glumes is, however, lower than for the Strübes variety; it is also about four days earlier than Strübes, and is thus enabled to ripen its grain more regularly and completely. For these reasons *Guldregn* remains the best type for the Norwegian districts.

Tests were also made with the Seger, Trifolium, Alna, Abundance, and Grenader varieties. All these proved inferior to the *Guldregn* and Strübes varieties. No exact judgment can be passed on the Grenader variety as it was tested only one year.

GENERAL CONSIDERATIONS. — In the western parts of southern Norway the cool, damp summer greatly favours the growth of oats, which give the highest yield in grain. Towards the interior and the east, however, the climate is always more continental, with warm, often dry, summers, especially favourable to the growth of wheat and rye. Nevertheless, even in the Taederen district, under conditions favourable to oats, the yield of this cereal is much greater than that of wheat, if the glumelles be considered in valuing the grain. If however, only the bare grain be taken into consideration, the difference is so small as to be almost nil. Placing the value of the grain yield of Börsum wheat at 100, the values for the bare grain of oats are: — Strübes Schlanstedter 100; Seier (Seger) 92; *Guldregn* 101; Trifolium 87, etc.

In Norway the prospects of wheat growing are improving in the Vestlandet and Sörlandet districts, where the soil, usually sandy and rich in humus, is very favourable to this cereal. Norwegian wheats ripen almost at the same time as the most common varieties of oats (semi-early) and, considering how heterogeneous they are (mixed types and populations) they might certainly be very greatly improved even by simple pure strain selection.

154 — Comparative Cultural Tests of Varieties of Winter Rye in Western Norway. —

GRANUM O. in *årsberetning om arbeid de offentlige foranstaltninger til landbrukets fremme i aaret 1917*, pp. 511-552. Christiania 1918.

This paper gives the results of a series of cultural tests made from 1912 to 1917 in the fields of the Agricultural Station of Vold and in different io-

calities of the provinces of Trondhiem, Nordland and Romsdal. The varieties studied were:— Trønder, Vasa (Norwegian), Vasa (Finnish), Petkuser, Refsum, Røttesmo, Balsnes, Stjern (of Svalöf), Muravief, Lekang, Løvø, Støone, Skileraas, and Common Norwegian winter rye. The following general averages were obtained for the grain yields (in lb. per acre):

VOLD. — Stjern (Svalöf) 2 751; Balsnes 2 733; Røttesmo 2 453; Petkuser 2 453; Refsum 2 398; Vasa (Norwegian) 2 326; Trønder 2 218; Vasa (Finnish) 2 005.

TRØNDER. — Balsnes 2 552; Røttesmo 2 254; Stjern 2 160; Vasa (Norwegian) 2 18; Refsum 2 100, Petkuser 2 091; Trønder 2 037; Common Norwegian 2 027; Vasa (Finnish) 1559.

ROMSDAL. — Petkuser 2 372; common Norwegian 2 362; Trønder 2 172; Balsnes 2 172; Vasa (Finnish) 1 846; Røttesmo 1 751; Stjern 787.

NORDLAND. — Trønder 1 801; Petkuser 1 728; Balsnes 1 692; common Norwegian 1 692; Vasa (Finnish) 1 683; Røttesmo 1 621; Stjern 1 574.

The data collected during the tests confirm the author's previous statement that, in spite of the unfavourable climatic conditions, rye should be more widely grown because of its high yield in grain and straw in many districts in the provinces of Trønde, Romsdal, and Nordland. In Nordland the most suitable variety is, without doubt, Trønder, distinguished by its great resistance to winter conditions. In milder districts, with a constant climate during winter and a good, continuous cover of snow, Petkuser rye may also be grown successfully. Under very difficult environmental conditions good results may be obtained with the Vasa (Norwegian), Refsum, Balsnes, and Røttesmo varieties.

455 - *Avena sativa* var. *Ampuria* and *A. s.* var. *Colomea*, Two Good Varieties of Oats Acclimatised in Argentina. — GIROLA G. D. in the *Analisis de la Sociedad rural Argentina*, Year I, 1911 III Vol. No. 7, pp. 441-447 + 5 Figs. Buenos Aires, July 1918.

The author describes two good varieties of oats introduced into the Argentine by M. J. BRÚ who named them after the two localities of Catalonia (Spain) of which they are natives — *Ampuria* and *Colomea*. The author considers these two varieties, now completely acclimatised, to be worthy of being grown more widely by reason of the following qualities — resistance to frost and drought, abundant tillering, high yield as well as weight of grain per bushel (44 to 48 lb., as compared with 40 lb. or less for the common oats of the Argentine), large, well-formed grain, rich in flour and stimulant elements (avenin and vanillin).

456 - "Yellow Early Ardiszone", Rice. — MARCARILLI B., in *Il Giornale di Riscicoltura*, Year IX No. 2, pp. 20-23 + 1 Fig. Vercelli, February 28, 1919.

In 1915 Signor P. ARDISZONE, at Cascina Angossa, Vercelli, isolated this new variety from the "Chinese originario" rice which was being selected in the experiment fields of the Rice culture Experiment Station of Vercelli. Propagated and tested under the most varied conditions, this variety gave

such satisfactory results as to encourage the hope that it may soon be largely grown. On sprouting this rice is of a lemon yellow colour variegated with green. This character forms one of the most important cultural qualities of this rice because, when planted in fields invaded by weeds, it is possible at any stage of its growth to weed completely, even though the weeder be inexperienced, by reason of the striking difference between the green of the weeds and the yellow of the rice.

The agricultural qualities of "yellow early Ardizzone" rice are those usually found in the common early rices derived from "Chinese originario" (1); like them it is earlier than others and requires less warm irrigation water. The vegetative cycle does not last more than 140 to 150 days. It is, therefore, well suited to old rice fields so long as the land is not over cold. It may be sown from March to the end of April, but the best time is the first half of April. Sowing must be fairly thick (at least 116 to 124 lb. per acre).

Average height of plant	80-85 cm
Length of panicles	10-20 "
Number of spikelets per panicle	8-10 "
Length of spikelets at base	7-8 "
Length of spikelets at summit	6.65 "
Number of grains per panicle	90-130 "
Weight of 1000 grains of paddy	28.5-28.6 gm
Weight of 1 litre of paddy	600-610 "
Number of grains of paddy per litre	21 050-21 350
Size of grains of paddy {	length 7.30-7.60 mm
	front diameter 3.40-3.60 "
	side diameter 3.25-3.30 "
Percentual yield at harvest {	commercial type 71-72 %
Threshing by weight	waste 3.2 %
Date of ripening	1st half of September
Yield in paddy per acre	35.3-41.0 cwt

Morphological, commercial and cultural characters. — A low, straight, not very vigorous rice; thin yellow green stalks, not very resistant to lodging, curved at the top, with light nodes; leaves short, little developed, lemon yellow in colour, more or less marked with green, from when they emerge till they ripen. Very compact panicles, not very arched, of average length and thickness with thin elastic rachis and numerous spikelets differing little in length; numerous grains of similar size to those of "Chinese originario", of a fine straw colour with a reddish tinge when ripe, not very thick glumes, slightly hairy with not very pronounced ribs and rudimentary awns, small glumelles of a not very marked yellowish colour at the base of the glumes. Inside the grain has a thin perisperm and a compact, glassy endosperm which, when polished gives a very transparent commercial type, of a shining, slightly yellow, pearl colour; this colour disappears in cooking which this rice resists much better than "Chinese originario". Its tillering capacity is average, in some cases superior to that of common

(1) See R April, 1917, No 330 (Ed)

early rices. The ratio between the weight of paddy and that of straw is within the limits attributed to the most productive rices. The yield at polishing is good and the percentage of waste low. The time of ripening corresponds more or less to that of "Sancino" (1); although it is a few days later than this rice and "Early Dellarole" (2), if sown at the same time it is rarely later than September 10 to 20. The yield varies from 35.3 to 41.0 cwt. per acre; in new rice fields it may reach 41.0 cwt. and more.

- 457 — **Mechanical Sowing and Weeding of Rice by the Cabrini Method.** — CABRINI A., in the *Giornale di Riscoltura*, Year VIII, No. 10, pp. 150 151 + 2 Fig.; No. 11, pp. 168 173. Vercelli, October 31 and November 30, 1918.

Instead of sowing rice broadcast the author uses a special drill invented by himself. By means of cuniform skids this drill works the soil into shelving beds on the top of which the seed is placed. When weeding a special machine is passed between these beds. This machine also has cuniform skids fitted with projecting blades which cut the weeds between the beds and on their sides; hand weeding is thus limited to the tops of the beds i. e. among the rows of young rice plants. In the rows sowing is close (plants 1 or 2 cm. apart), and the best distance between the rows is 30 cm. It is well to do the first weeding by hand as early as possible and to follow it after a few days by the first mechanical weeding. Ten or twelve days later the second mechanical weeding should be done and, a few days later, the second hand weeding. It is sometimes necessary to weed mechanically a third time, and even by hand a third time.

In 1916 the results of the CABRINI method were compared with the ordinary method of sowing broadcast and weeding exclusively by hand, on two plots of 5.94 acres. The first yielded 263.7 cwt. of paddy at a cost of 232 fr. (1 franc — 9 1/2 d. *at par*) for weeding (mechanical weeding + hand weeding within the row), and the second method yielded only 229.0 cwt. of paddy at almost twice the cost (436 fr.) for weeding done exclusively by hand.

- 458 — **Rice in Cochín-China: Experiments in Mechanical Culture.** — See No. 508 of this Review

- 459 — **"Ghessab", (*Pennisetum typhoideum*) as an Irrigated Fodder Plant in Hot Countries, especially Tripoli.** — LAYON, V., in *L'Agricultura coloniale*, Year XII, 2nd Half Year, No. 5, pp. 324 326. Florence, November 15, 1918.

In Tripoli, during the long summer droughts, which make fodder very scarce and very expensive, the stock either die or are extremely underfed; it is, therefore, necessary to the health of the animals to find grasses which will adapt themselves to these districts. After alfalfa, the numerous mowings of which (from April 10 to 15 December) always give a profitable product, but which requires much water (in summer it has to be irrigated every five days), "ghessab" (*Pennisetum typhoideum*) is very well suited to grass land. This grass reaches a height of from 33 inches to 6 1/2 ft., according to the way the land is prepared and to the amount and quality (fresh or

(1) See R Dec., 1916, No. 1277 — (2) See R July, 1918, No. 756 (Fd)

brackish) of the water it receives. It is sown in soil prepared in beds ("gedulie") and irrigated; three days later the soil is green. In 30 or 40 days, with 5 or 6 irrigations the plants are fully grown. It is left another two months for the grain to ripen. The grain is excellent for making bread or porridge, but is also eaten as it is, and used for making beer or alcohol. If the plant is cut with a sickle above the first node when on the point of flowering and irrigation continued, a second crop may be obtained. It may be sown from the end of May to the end of August. Hot weather is essential to regular and vigorous germination.

The following account of cultural expenses concerns a meadow sown in a brackish water district where "ghessab" grows more slowly and less high (1).

450 sq. metres sown with 3.25 kgm. of seed @ 6 fr. the kgm.	fr.	8.40
Mun's Labour (preparation of land, fertilising, sowing, 6 irrigations)	"	27.00
18 days at 1.50 fr.		
Horse labour (transport of fertiliser, drawing of well water); 11 days at 5 fr.	"	70.00
(in good years only 2.50 fr.)		
Rent of land for 3 months.	"	5.00
Wear of skin pulps and rope	"	3.00
<hr/>		
Total expenditure	fr.	113.40
Expenditure per hectare	fr.	2 520.00
Yield of 1st crop	kgm.	1,840
Yield of 2nd crop ($\frac{1}{3}$ of the 1st)	kgm.	610
<hr/>		
Total yield	kgm.	2,450

In round figures the yield is 24 quintals at 10 fr. the quintal - 204 fr., or 5 333 fr. per hectare.

In round figures, then, a net profit of 2 700 fr. per hectare may be relied on. This profit is higher if, as is sometimes done, the green fodder be sold in bundles of about 0.8 kgm. (sold at 15 centimes in 1917).

Stock relish "ghessab" fed either fresh or dried and chopped (after the grain has been harvested), and thrive on it.

46) - "**Pasto salitrero**" (*Sporobolus phleoides*) as a Fodder Plant for the Saline Soils of Argentina. - DIAZ C., in the *Revista de la Sociedad Rural de Córdoba*, Vol. XVIII, No. 313, p. 1115. Córdoba, Argentine Republic, July, 1918.

The Argentine has thousands of square miles of saline soil ("tierras salitrosas") which are almost unused. As a fodder plant for this district "cachiyuyo" (*Obione pamparum*?) has been recommended, but the author considers *Sporobolus phleoides* to be superior. This perennial Argentine grass may reach or exceed a height of 3 $\frac{1}{4}$ ft. It lives exclusively in saline soil, where it withstands a high salt content, and is very resistant to drought. It is prevented from spreading spontaneously because, when its very fine seed falls on the bare earth it is swept along by the wind. An analysis

(1) 1 kgm = 2, 1b = 17 metre 10, 6 q lect 1 f = 9 $\frac{1}{4}$ d at par (Ed)

of the plant showed it to have the following percentual composition : — Water 14.41 ; fat 2.80 ; crude protein 8.30 ; crude fibre 23.15 ; carbohydrates 30.17 ; ash 8.26 (4.06 % soluble and 4.23 % insoluble) ; undetermined substance 12.88. An analysis of the surface layer of the soil in which the plant analysed grew gave the following percentages :— Moisture (hygroscopic) 2.25 ; fine sand 62.50 ; clay 20.36 ; limestone 2.14 ; humus 1.25 ; water-soluble salts 11.50. This fodder plant is much liked by cattle and horses.

FIBRE CROPS

161 - **Manurial Experiments with Sea Island Cotton in St. Vincent in 1917-1918** (1).

— HARLAND S C, in the *West Indian Bulletin*, Vol XVII, No. 2, pp 60-79 + 2 Tables + 3 Diagrams. Bridgetown, Barbados, 1918.

The results are given of fertiliser experiments on cotton (Sea Island variety) made at St. Vincent, Lesser Antilles, from 1917 to 1918. The results showed that the yield of fertilised plots is higher than that of non-fertilised ones. *The plots receiving most potash gave the highest yields* (116 % more of seed cotton than in the non-fertilised plots).

Potash alone is more efficacious than when mixed with phosphatic fertiliser, which even decreases the yield. The physiological disease of cotton known as "rust" is due to a shortage of potash. The fertiliser and spacing have no effect on the percentage of bolls. If two plants are left in each hole a much higher yield is obtained than when one plant is left in each hole.

The flowering curves and bolling curves are given and compared with those of the previous year. These curves are very uniform with respect to the period of flowering, its rise and fall. In countries where the water supply depends on the rainfall the utility of these curves is relative and much inferior to their utility in countries where irrigation is possible, as in Egypt. The author does not think these curves are of any practical use to growers, but they are indispensable for the comparative study of the yield of different varieties.

162 - **Cotton Growing in Paraguay.** - *Revista de la Unión Industrial Uruguaya*, Vol XX, No. 27, p. 135. Montevideo, 1918.

Cotton is the most important of the agricultural products of prime necessity in Paraguay capable of being profitably developed commercially, because, in addition to the large local demand, there are the yet larger demands of the neighbouring South American Republics and of Europe. According to the more reliable statistics there were from 190 000 to 200 000 cotton plants in Paraguay in 1886. This number remained more or less stationary till 1901, when it rose to about 300 000, yielding 8 800 lb. of cotton. In 1904, the "Banco Agrícola" of Assumption started active propaganda for the development of cotton growing in Paraguay ; this propaganda has been more or less successfully carried on up to the present.

In Paraguay the native cotton plant lives and produces for 10 to 12 years, thus making frequent sowing unnecessary. One of the chief

(1) See also R Fch, 1919, No. 197 (Ed.)

obstacles to the production of cotton in Paraguay is the lack of sufficient means of transport between the most productive districts and their outlets. These difficulties are gradually disappearing as new roads and railways are being constructed and river transport improved. In some districts there is much coloured soil containing sufficient clay and lime and a little iron oxide equally well suited to the growing of cotton or tobacco (the best Cuban tobacco is grown in soil of this kind).

In 1918 the lack of jute bags was a great loss to growers, but was only temporary. As the prices are high at present and will probably continue so for some years, cotton growing in Paraguay should increase more than ever, and continue to gain in importance.

463 - **Sisal in Africa.** - *Tropical Life*, Vol. XIV, No. 1, pp. 4-5; No. 2, p. 20; No. 3, pp. 35-36. London, January, February, March, 1918. Abstract in the *Bulletin économique de l'Indochine*, Year XXI, N. S., No. 13, pp. 991-992 Hanoi Huiphong, September-October, 1918.

Information is given on the English and German East African *Agave sisalana* plantations. Data obtained from well-informed travellers or the heads of the principal agave plantations show that, under conditions very different from those under which it is successfully grown in America, sisal dies soon, raising its pole (a sign of its near death) after the 6th year. Thus, since the plant must be at least 3 years old before the leaves can be picked, growers only harvest during 3 years, sometimes only 2 1/2. This is a very short, and not very encouraging, time. Even if a good yield be obtained during the three years, the conditions are decidedly disadvantageous as compared with those in Yucatan or the Bahamas. The total average yield for six years in Africa is 1100 lb. of dried fibre per acre a year. In America the same yield for a period of 20 years is 1800 lbs.

Mr. R. H. HERON gives interesting information on the formation of plantations, the use of bulbils taken from the poles and suckers taken from the parent plant. The bulbils reproduce the qualities of the parent plants with less certainty than the suckers. The young plants cannot be planted out immediately, but must be kept in the nursery for at least a year, though they require little attention. Suckers keep longer than bulbils.

When sisal is planted near an old plantation with poles there is great advantage in using bulbils. A large number of fairly fresh ones are collected by shaking the poles bearing them. When taken from the nursery, at a date which may vary by some months, all the plants are of the same age and of about the same size and strength. This is a great advantage. Planting by means of bulbils therefore, means waiting some time, but the plants live longer than those springing from suckers.

Suckers are more expensive to obtain than bulbils. The plantation must be gone through, the suckers chosen with care, taking, as far as possible, only plants of equal vigour. This is never quite possible and consequently, the new plantation will always have some irregularity which is more marked towards the end.

With suckers it is possible to harvest much earlier. On the other

hand, it may be profitable to replace failures and fill gaps in a plantation by means of large bulbils.

It is well to take suckers from standing stock as the shoots of a plant are capable of doing it more harm than anything else. Since the suckers must be removed it is well to utilise them by planting them.

RUBBER,
GUM AND RESIN
PLANTS

464 - **Rubber Producing Plants of Minor Importance.** — PEARSON H. C., in *The India Rubber World*, Vol. LX, No. 1, pp. 201-202 + 3 Figs. New York, January 1, 1919

The author describes plants of the temperate zone (Central and Southern Europe, South Russia, and Asia Minor) from which rubber might be obtained when there is shortage of the normal product. These plants are, according to PRINZHORN:—

Sicilian artichoke (*Abrotylis gummifera* L.) (1). — Composite resembling the artichoke. Its root contains: — rubber 36.46 %; resin 51.52 %; organic impurities 1.40 %; mineral impurities 2.31 %; albuminoids 4.07 %; water 4.24 %.

Spindle tree (*Euonymus europaeus* L.) does not contain sufficient rubber to cover cost of extraction.

Sow thistle (*Sonchus oleraceus* L.) contains, in addition to rubber, two colouring matters (green and yellow) and a wax.

Euphorbias (*Euphorbia pilosa*, *E. palustris* and *E. Cyparissias*), plants of central Europe, all contain rubber which, according to SCHIERMESSER may be extracted as follows: — the plants are picked when nearly ripe, dried, crushed, and the crude powder treated with a solvent; a dark green extract is obtained which contains a rubber-like substance and a fat. It is estimated that 1 acre of *E. Cyparissias* will yield 44 lb. of rubber and 125 lb. of fat suitable for soap-making and also of food value.

Euphorbia (*Tithymalus*) *Peplus* cultivated and treated as the two preceding Euphorbias will yield 38 lb. an acre of rubber and 107 lb. of fat.

465 - **The Cultivation of Rubber-Plants in the Philippine Islands.** — JUMELLE H. in *La Caoutchouc et La Gutta Percha*, No. 180, pp. 970-9704. Paris, February, 1919

Although the Philippine Islands are rarely mentioned among rubber-growing countries, yet the crop has been cultivated there for some years now, especially in the provinces of Moro and Mindoro. The first attempts were made in 1905 in Basilan Island with *Manihot* (*Glaziovii*), which afterwards was abandoned, being replaced by Hevea. In the province of Moro, a large plantation, started in 1910, already covered nearly 2 000 acres in 1912; in the province of Mindoro two companies divided between them the same number of acres in 1912. In that year the total area planted with rubber in the Philippines was 5 928 acres, of which 90 % was Hevea and 10 % *Castilloa*. The Hevea finds the best conditions for growth in the southern part of the Philippines, for the soil is suitable, the temperature rarely goes above 33° C., there is no dry season as there is in the north and the rain is distributed throughout the year. The author thinks that rubber-growing will develop greatly in this part of Malaysia, all the

(1) See R. Murch, 1911, No. 875 (Ed.)

more since the United States, with their enormous rubber-consumption, have every interest to increase the area under rubber in the only part of their colonies where the crop has any chance of success.

466 - *Coffea excelsa* and its Cultivation in Indo-China. - CHEVALIER AUG., in the *Bulletin agricole de l'Institut scientifique d-Saïgon*, Year I, No. 2, pp. 13-19. Saigon, January, 1910.

STIMULANT,
AROMATIC,
NARCOTIC AND
MEDICINAL
PLANTS

The cultivation of coffee in Indo-China is of the greatest interest and urgently needs developing. Costly experiments have been made with a view to acclimatising this crop in Indo-China; they have lasted over 30 years in Cochin-China and over 15 years in Tonkin. After this long series of attempts, satisfactory results have at last been obtained. *Coffea arabica*, when treated as an intensive crop, i. e., planted in soil that is frequently cultivated, kept absolutely free from weeds and suitably manured every one or two years, gives remunerative crops. It is not exempt from disease, but it can be controlled.

Other species and varieties of coffee, discovered in Africa during the last 20 years, such as *robusta*, kouilou, *excelsa*, *abeokuta*, Uganda, etc., already begin to yield in Java and Sumatra. *C. robusta*, in particular, has replaced the species *arabica* and *liberica* which were acclimatised a long time ago (1). It also does well in Cochin-China (Suzanna-Anloc and Loc-ninh plantations), where it is known to the planters as "Chari" on account of its origin; in fact, *C. excelsa* was found by the author in 1903 in Central Africa, on the banks of the small river Gouvda, a tributary of the Chari basin.

The note following the introduction summarised above was published in 1914 in the *Journal d'Agriculture tropicale* (Year XIV, No. 157, pp. 193-196, Paris, July 31, 1914) and a summary was given in this *Review* (2). The author has completed it by an appendix describing the further observations described below.

Since 1914, the cultivation of *C. excelsa* has made great progress in the Dutch East Indies. The selected seed is always bespoken a long time in advance at the Bangilaw Station and the plantations of this species have extended a great deal. In Indo-China the experimental period has not yet been passed. Some important facts have, however, been brought to light. In Tonkin, this species, though more resistant to cold than *liberica*, is much less so than *arabica*. At Tuyen-quang, a plantation of "Chari" was severely damaged by several cold nights in January, 1918, when the thermometer went down to + 2° C. and even to 0.4° C. Only those trees resisted that were sheltered by shade-trees. The frozen coffee-plants, which were cut down to the level of the soil, mostly gave out new shoots. In the south of Tonkin (Borel plantation) the "Chari" variety did not suffer from the cold; however, M. MARIUS BOREL

(1) For coffee of the *robusta* type see R., March, 1910, No. 322, for an account of its cultivation in Ceylon (Ed.)

(2) See R., October, 1914, No. 902. (Ed.)

thinks that it yields less than *arabica*; but, owing to its great resistance to disease, he advises its use as grafting-stock in certain regions where the roots of the former species suffer from a disease. In Cochín-China, the author has made very interesting observations on this species. The *excelsa* and the variety from Lagos named *abeokuta* by M. CRAMER are growing very finely in some districts. They are disease-resistant, while *arabica*, unmanured and grown in "grey soil" (1), falls away very rapidly, as has been shown, for over 30 years, by the negative results obtained in various parts of Cochín-China. "Chari" and *abeokuta*, thanks to their strong tap-roots, which penetrate deeply in the "red soil", (2) suffer much less than the other species from the droughts that occur in December and April.

They apparently do not even need shading, provided that the soil is kept free from weeds and moved every one or two months by shallow ploughing and that all precautions are taken in the rainy season to prevent washing, as the erosion of cultivated soil constitutes one of the greatest dangers of tropical agriculture. At the Bencat Station (manured grey soils) and at the Xa-cat plantation (unmanured red soils), certain plants of these varieties have yielded over 1kg. of marketable coffee after the third year. A few plants, it is true, have remained sterile, but, according to M. P. J. CRAMER'S suggestion, the sterility can be remedied by grafting branches from the most fertile plants on to the sterile ones.

Experiments at the Saigon Botanic Garden, under the direction of M. P. MORANGE, have shown that the grafts recover easily.

In conclusion, it may be said that *C. excelsa* and its varieties appear to be among the varieties of coffee that are the most suitable for diffusion in Indo-China.

467 — **The Introduction of Improved Tea Plants into Indo-China.** — CHEVALIER A., in the *Bulletin agricole de l'Institut scientifique de Saigon*, Year I, No. 2 pp. 51-52. Saigon, February, 1910.

The Tea Section of the Congress of Colonial Agriculture held in 1918 has asked the Administration to provide the Experiment Station founded in 1918 at Phu-Tho (Tonkin) for the improvement of coffee and tea growing, with the means and stability that will enable it, by working on sufficiently large crops, to obtain really practical results.

With a view to this programme, the author has tried to gather together at the Phu-Tho Station, and also at that of Giaray (Cochín-China), the chief varieties of tea and coffee grown throughout the whole world.

Amongst tea-plants the pure Assam varieties are particularly appreciated. The author obtained a large shipment of seed of the "Dangri" and "Manipur" varieties from the "Syndicat des Planteurs de Thé de l'Assam" and from the Dangri and Donjan Tea Seed Syndicate of Dibrugarh (Upper Assam). He is expecting more improved varieties from Java, Ceylon and China. He has begun to collect at Phu-tho

(1) and (2) For the "grey soils" and "red soils" ("terres grises" and "terres rouges"). see R, February, 1910, No. 205. (Ed.)

the chief varieties of tea grown in the different regions of Indo-China, as well as three species that grow wild in the forests of Tonkin, whose leaves are utilised by the natives. He has also transplanted to Chua-Chuan, near Giaray, a wild tea plant living in the virgin forest on the Annamite mountain chain at about 5 000 ft. high; it closely resembles an Assamese tea plant discovered by 1918 by Dr. YERSIN on the Honba massif, where the author has recently studied it.

468 - **The World's Production of Cocoa in 1917 and the Interest of Cocoa-Growing in Indo-China.** - CHEVALIER A., in the *Bulletin agricole de l'Institut scientifique de Saigon*, Year I, No. 2, pp. 55-56 Saigon, February, 1919

Originating in the warm parts of South America, the cocoa tree has, as regards climate, much the same requirements as Hevea; it does well in rich soils, but it requires shading; the shade plant that is usually preferred is the banana. At present it is in tropical West Africa and its islands that this crop reaches its highest point. These countries furnish more than half the world's production and provide for the needs of Europe.

The world's production of cocoa reached, in 1917, approximately 332 000 metric tons, against 295 000 metric tons in 1916, 298 000 in 1915 and 277 000 in 1914. From 1914 to 1917, the increase was, therefore, 54 800 metric tons. This increase is chiefly furnished by the British Colonies, as their production went up from 101 842 metric tons in 1914 to 145 160 metric tons in 1917. In most countries, however, there was a decrease in production from 1914 to 1917, except in the case of Brazil, where it went up from 40 767 metric tons to 55 622 metric tons. The production of the French Colonies is on the decrease: 1824 metric tons in 1914 and 1 600 m. tons in 1917.

The following figures give the production, in metric tons, of cocoa per country in 1917: - British Colonies, 145 160; Ecuador, 40 000; Brazil, 55 622; San Tome, 30 884; Fernando Po, 3747; Venezuela, 16 000; San Domingo, 24 300; Haiti, 1543; Cuba, 1300; Java, 1555; Surinam, 1927; French Colonies, 1600; Belgian Congo, 784; late German colonies, 4000; other countries 3500. - Total, 332 100 metric tons.

In the regions near Indo-China, Java and Ceylon produce a certain amount of cocoa. In several points of Cochin-China, and at Suoi-giao (South Annam), there exist a few cocoa plants that produce a fair quantity of fruit each year and grow free from disease. If, as appears probable, chocolate and products with cocoa and cocoa butter as a basis, find markets in the Far East, it would pay to start a few cocoa plantations in Cochin-China.

469 - **Bay Oil and Bay Rum.** - Royal Botanic Gardens, Kew, *Bulletin of Miscellaneous Information*, No. 4, p. 158-160. London, 1918

The manufacture of bay oil and bay rum are important industries in the West Indies which have been developed chiefly during the last fifty years. Bay oil is the product of the leaves of the "West Indian bay tree," *Pimenta acris*, Kostel, which is known locally by several other names, and the oil is employed in the manufacture of bay rum, which is largely used

as a hair wash. The leaves are gathered chiefly from wild sources, and the volatile oil extracted by a process of distillation.

The industry has suffered much from the admixture of the leaves of two forms of *Pimenta acris* known as "Bois d'Inde Citronelle" and "Bois d'Inde Anise", which are so similar as to be distinguished with difficulty. "Bois d'Inde Citronelle" is known botanically as *Pimenta acris*, var. *citrifolia* (*P. citrifolia*, Kostel., *Myrtus citrifolia*, Poir.); the oil has the taste and odour of lemon, owing to the presence of citral, which reduces the value of the true bay oil if mixed with it. "Bois d'Inde Anise" does not appear to have been distinguished botanically, but its oil also is an equally undesirable product which reduces the value of bay oil. The true economic plant is known as "Bois d'Inde", or bay rum tree. The frequent appearance of the leaves of these two varieties amongst produce sold as "Bois d'Inde" leaves is not only a matter of considerable inconvenience and possibly loss to distillers of bay oil, but tends to give a bad name to the Dominica samples of bay oil leaves submitted to distillers.

The principal difference detected is in the fragrance of the bruised leaves, that of the "Bois d'Inde Citronelle" being citron-scented, while the others are simply aromatic: a characteristic of little practical value in collecting leaves from wild sources, or in subsequently detecting adulteration; more over it fails in separating the "Bois d'Inde Anise".

In the event of the plant being brought under cultivation, as has been suggested, owing to the inaccessibility or destruction of the trees in their wild habitats, steps should be taken to ensure that the plants selected have been derived from a pure stock of true *Pimenta acris*, Kostel. At present the leaves are collected from the wild plants in several islands, including Dominica, Porto Rico, Montserrat, St. John's, the Virgin Islands and other localities.

The case of varietal forms of *Pimenta acris* affords a parallel to those of camphor, *Cinnamomum camphora* and chicle gum, *Achras Sapota*. Of both these plants more than one form is known to exist and the instance of the bay tree affords yet another example of the absolute necessity of making sure of the value of any particular strain or physiological form of an economic plant before establishing plantations on an extensive scale.

HORTICULTURE: 170 - **Propagation of the Potato by Using the "Eyes", an Experiment made in the Ardèche (France).** - BOISSET H, in the *Journal d'Agriculture pratique*, Year LXXXIII, N° 1, pp 14 15 Paris, January, 9 1910

The proposal has recently been made to utilise, as "seed" for the potato crop, the eyes (1) with a very small amount of tuber adhering. The author (Director of the "Services Agricoles" of the Ardèche) has carried out a methodical experiment, using the variety "Institut de Beauvais", by comparing the yield from planting whole potatoes and from eyes weighing an average of 8 gm. each. At harvest-time, the plants

(1) See R. Murch, 1917 No. 210 (Growth from sprouts) and R, April 1917, No. 332 (Using potato-skins). (Ed.)

produced from eyes were found to bear very small potatoes. Thus, by using very small pieces of tuber as seed, there was a saving of $\frac{5}{6}$ of the amount of seed, or 26 kg. per are, but there was a loss of 153 kg. on the harvest.

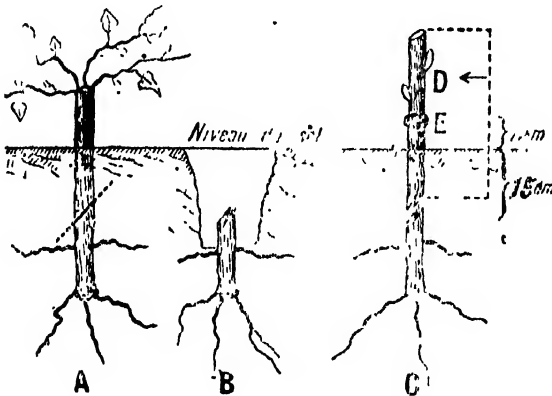
471 - "Over-grafting" the Vine. — I LARUE, PIERRE, in *La vie agricole et rurale*, Year IX, No. 1, p. 9 + 1 fig. Paris, January 4, 1919. — II BLANCHARD E, in *Ibid*, Year IX, No. 2, p. 130. Paris, February 22, 1919.

VINE GROWING

I. -- When a vine wastes away, its roots can be utilised by grafting a more suitable variety on them. This operation has not much chance of success, when the stock itself is weakly. It would be better to plant a young vine. As the struggle with the surrounding roots is a difficult one, it should not be grafted before two years, when it will be well rooted. But visiting isolated plants wastes time. To avoid having to free the scions, it is better to use a vine that is already grafted.

"Over-grafting" (French: "surgreffage") is a current practice in the vineyards of the Cape, and M. PEROLD, chief viticultural expert, cuts the American stem 15 cm. below the soil; he grafts, using an English cleft-graft, a healed grafted vine whose intermediary stock has a length of about 17 cm., 2 cm. of which projects above the soil. The intermediary stock gives off superficial roots that nourish the plant.

Scheme for "over-grafting" (after PEROLD)



Niveau du sol -- ground level

A -- American vine in the ground (1 to 2 years)

B -- The same, cut for grafting

C -- "Over-grafted" vine.

D -- Scion itself already grafted.

E -- Place where D was grafted the previous year

"Over-grafting on a European scion succeeds better than on an American one; it should, therefore, be used in preference when one or several rows of well-rooted but unsuitable varieties are to be replaced.

II. -- M. BLANCHARD refers to the system of "over-grafting" described by M. LARUE and shows its advantages; by means of it poor yielding plants can be rapidly replaced by better ones, the value of a vinifera or hybrid stock can be quickly studied, and the top of a plant which has been injured by storm or is deformed can be renewed.

The author has carried out "over-grafting" at Jas-de-Bouffan, near Aix-en-Provence. In the vineyard Chasselas grapes were "over-grafted" on to 25 year-old Jaquez that produced next to nothing. The first year, i. e., the same year as that of grafting, the Chasselas yielded more than the Jaquez. The second year there was an extraordinary crop. It was the case, not of grafting late, but of "over-grafting", for Jaquez (direct bearer) has long been grafted on Jaquez in Provence, and it is still grafted on various stocks.

At Jas-de-Bouffan, crown-grafting was carried out. The author has also employed double cleft-grafting; on some occasions single cleft-grafting is necessary; it naturally depends on the size and vitality of the stock.

The author recommends over-grafting in the Loire region to save time in studying direct hybrid bearers.

Over-grafting is as suitable for the vine as it is for other fruit trees. But as the vine is one of the most plastic of trees, the operation is still more easily successful.

472 - **Vine Growing on the Rich Plains of the Algerian Shore.** — VIALA (from the work by M. BERTRAND), in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 7, pp. 206-209. Paris, February 10, 1909.

M. VIALA has presented to the "Académie" one of the most important works that have been published on vine-growing for the last twenty years.

M. BERTRAND, the author, has managed one of the finest vineyards in Algeria for 47 years. In the rich, deep, well-watered soils of the Algerian coast, he has greatly increased the distance between the trees in the rows and that from row to row. He plants only 1333 vines per hectare (= 536 per acre), with a space of 6ft. 6 in. to 8ft. between the rows and a distance of 9 ft. 9 in. from tree to tree in the row, thus making it possible to cultivate by means of power-driven implements. The vines are grown regularly on iron wires.

Having foreseen the new trend in the consumption of wine, instead of producing coloured wines of high alcohol content, he has aimed at producing a relatively light wine, by the exclusive use of two varieties: "Cinsault" and "Clairette égrenée"; by means of selection, he has obtained from these vines a yield of 150 hectolitres per hectare (1336 gallons per acre) for "Cinsault", which gives an average yield of 40 to 50 hectolitres, and 250 hectolitres per hectare (2226 gallons per acre) for "Clairette égrenée" which gives an average yield of 80 hectolitres.

Having replanted with American vines, he was the first in Algeria to use (on 300 hectares) hybrids of *Berlandieri* and especially of 420-A.

With the latter, by using cuttings and supplying abundant water, almost as many took as with ordinary varieties (65 %).

M. BERTRAND was one of the first to organise Viticultural Societies in Algeria; these have become very important during the last five years: he founded one society that now owns about 5 000 hectares of land, 1200 of which are planted with vines. He was the first to use reinforced concrete vats, the smaller ones holding 800 hectolitres and one holding as much as 3 000 hectolitres.

473 - **The Effects of Forest Regeneration, especially of Pines, on Soil Nitrification, Researches in Sweden.** — HESSELMANN H., in the *Meddelanden från Statens Skogsförsöksanstalt*, Part 13 14, pp. 923 1076 + 18 Figs. + Bibliography of 51 publications. Stockholm, 1917

LORI NRY

In the greatly discussed problem of the regeneration of forests, the part that has been least studied, although it may possibly be the most important, is that of the physiology of regeneration for which the three factors of climate, provision of light and nature of the soil must be taken in to account.

The soil should be considered from two points of view: 1) its greater or less power of favouring germination; 2) its capacity for supplying plants with the nutritive principles they need during the first years of their growth. These two qualities are not necessarily found united in the same soil. The author particularly considers the second, in relation to normal forest-management, and, for theoretical and practical reasons he first deals with the question of the nitrogen of forest soils (1).

Little or even no nitrification takes place in the mossy soils of the Swedish pine forests; the organic nitrogen does not pass beyond the ammoniacal stage even in the most productive of the mixed pine forests. Clearings that admit much light have a marked influence on the transformation of the nitrogen; in those places where the layer of humus, composed of moss and dead needles, is rather thin and loose, clearing may lead to the nitrification of the humic nitrogen, because it produces a radical change in the bacterial flora of the layer of humus; but when the layer is compact all that apparently happens is a more active transformation of the nitrogen of the humus, which does not however, reach the stage of nitrification.

The successive changes taking place in the layer of humus can be determined, up to a certain point, according to the soil flora: where the soil nitrogen is undergoing nitrification nitrophilous plants appear, such as the raspberry (*Rubus Idacus*), rose-bay (*Epilobium angustifolium*), sandwort (*Arenaria trinervia*), *Galeopsis bifida*, *Senecio sylvaticus*, sheep-sorrel (*Rumex Acetosella*), etc.; where the layer on the contrary, is being transformed into mould, without nitrification of the humic nitrogen, the characteristic plant of clearings, *Aira flexuosa* (wavy hair-grass), predominates.

(1) See R. Junt, 1918, No 624 (Ed)

A careful way of preparing the soil consists in mixing the covering of humus with the mineral soil, and if dead wood and twigs are buried it favours nitrification, even in the case of quite compact coverings. Paring and burning has the same effect.

There is a close parallelism between the nitrification of the humic nitrogen and the possibilities of regeneration. Forests where even ordinary thinning brings about nitrification are regenerated fairly easily; similarly road-side slopes, places where stumps have been chopped and burnt, are often characterised by nitrification of the humic nitrogen and by fine regeneration; again, fallen trunks and twigs favour nitrification and consequently regeneration. On the contrary, however, regeneration is difficult in soils of compact humus where there is no nitrification. Both from the results of experiments and from direct observation of nature, it would seem that the young Scotch fir (*Pinus sylvestris*) grows more vigorously in soils having a humus layer in which nitrification takes place than in the opposite case, and the same is probably true for the spruce also. In spruce-forest with a grassy ground, nitrification usually goes on in the soil and increases after cutting, which may sometimes result in an under-growth injurious to the spruce; these trees, it is true, do not favour the growth of vegetation in the underwood owing to their tendency to form compact little groups, but, all the same, it is often important to limit the vegetation in the glades, so as to lessen a competition that might be fatal to the wild trees.

The conclusion is that, for operations relating to regeneration, it is necessary to be guided according to the mode of transformation of the humic nitrogen in forest soils.

474 - **The Aleppo Pine (*Pinus Halepensis*), in Tunis.** — BAGNOL, in the *Bulletin mensuel du Gouvernement tunisien*, Year XIII, No. 105, pp. 185-186. Tunis, January-February 1910.

The Aleppo pine (*Pinus halepensis* Mill.), known in French as the "pin d'Alep" or "pin de Jerusalem", belongs to the Mediterranean region; it is known to the Arabs under the name of "snouber".

The author gives the botanical characters and habitat of the tree. It is widely distributed in Tunis; it occurs from the coast line up to the mountains in the centre, where it forms vast forests together with the evergreen oak, juniper, etc. It is specially abundant in the Oulad Ayar, near Haidra, at the south of Thala, Feriana and the neighbourhood of Gafsa. It prefers calcareous, warm, dry soils; it becomes bushy in soil that are too arid, but if the soil is suitable it grows rapidly.

The natives obtain "vegetable tar", and tanner's bark from the tree of which they also use the seeds and wood.

The author describes the native method for preparing tar, which is made exclusively from the Aleppo pine. The tar might be used pharmaceutically; it is used by the natives in the preparation of leather bottles, to protect animals against mange and the bites of flies and against various diseases.

Two other kinds of tar are made in Tunis, one from the Phœnician juniper, the other from the prickly cedar (*Juniperus oxycedrus*); the latter is considered the best for treating parasitic diseases.

The seeds of the Aleppo pine, called "zgougou" are sold at the rate of 60 to 70 francs per 100 kg. for making nougat.

After extracting the tan, the wooden poles are used in making terraces for houses, for building huts and for stakes. Old trees are used for making ploughs, pack-saddles for camels, saddle-bows, etc.

Besides its importance for replanting dry and arid calcareous hills, this pine is to be recommended as an ornamental tree for parks.

475 - The Forest Resources of Morocco (1). — GARDEY A, in *Colonies et Marine*, Year III, No. 1, pp. 33-40 + 6 Photographs Plates + 1 Map. Paris, January 25, 1919.

Morocco is endowed with important forest resources. From the technical point of view, the plant species are the same as those of the Algerian and Tunisian forests: — cork-oak, evergreen oak, Aleppo pine, *Thuja*, juniper. But many species found in Morocco and in Portugal as well, are lacking in Algeria, thus showing the clearly Atlantic character of the forest flora of the country. Another of its peculiarities is its vegetative power; in Morocco growth is so rapid that it sometimes reaches double that of neighbouring regions; for this reason the forests of Morocco have resisted the devastations that they have too often suffered at the natives' hands. While in Europe and the rest of North Africa the forests are distributed more or less evenly over the surface, in Morocco, they are concentrated in large masses and localised in four well-defined zones: 1) zone of cork-oak and *Thuja*; 2) zone of cedar and evergreen oak; 3) zone of the Grand Atlas; 4) zone of the argan tree (2).

1) *Zone of cork oak and Thuja* - This is included almost entirely in the Rabat region, to the south of Oued Sebu, but spreads, however, into the north-eastern part of Casablanca; the wooded areas are from 2 to 100 kilometres from the coast. It includes some forests covering a total area of 250 000 hectares, the most important of which is that of Mamora (130 000 hectares).

In most of these forests the cork-oak is of powerful growth: a tree usually reaches the size for cork-gathering (28 in. in circumference) at about 25 years, and over 8 ft. in circumference towards 55 to 60 years; this rate of growth is double that observed in Algeria for the same tree.

The annual yield of the cork-oak forests of Mamora has been estimated at 125 000 quintals (about 12 277 tons); the other forests could yield 30 000 to 40 000 quintals a year (2 946 to 3 928 tons.) The total annual production would be about 150 000 quintals which, at 30-35 francs a quintal, represent a gross value of 4 to 5 million francs (£ 160 000 £ 200 000), from which must be deducted the expenses of working, transport and care

(1) See R, June, 1916, No. 609 and January, 1917, No. 49 (Ed.)

(2) = *Argania Sideroxylon* Roem et Schult See R, 1911, No. 2713

at the rate of 6 to 7 francs a quintal, a sum of 1 000 000 to 1 200 000 francs.

The total area of the *Thuja* woods is about 50 000 hectares. There is an active native trade in the wood of this tree, which is used in cabinet-making and carpentry.

The stands of cork-oaks and *Tujas* are exploited by the Forestry Service.

2) *Zone of cedar and evergreen oak (Middle Atlas zone).* - - This is situated, in the Middle Atlas, to the south-east of the Meknes region, and is at an average distance from the sea of 200 kilometres. The oak forests usually begin at an altitude of 3 737 feet. The cedars only begin at about 4 062 ft., and grow more abundantly the higher they go.

In the Middle Atlas oak forests the evergreen oak and the "zang" oak (*Quercus Mirbeckii*) are present in the proportion of 10 to 1. The evergreen oak provides heavy wood used for railway-sleepers and wheelwright's work. The wood of *Quercus Mirbeckii* is very similar to that of the evergreen oak and is suited for the same uses. The cedars give a resinous wood which is suitable for beams and planks. The area under cedars is estimated at 300 000 hectares. The rational exploitation of the Middle Atlas forests has been undertaken by the Forest Service associated with the native wood cutters who have use of the forest by custom and who will form the staff of the State yards directed by the staff of the Waters and Forests Service. When the exploitation of the cedar forests on a large scale has become possible, the exportation to France may reach some 400 000 to 500 000 cu. metres.

The Middle Atlas forests also include important stands of the Phœnician juniper which could well replace the American woods for making lead-pencils.

3) *Grand Atlas zone.* - - This zone is little known. There are considerable forests, chiefly consisting of evergreen oaks, Aleppo pines, *Thujas* and, apparently, cedars in the north-east part. These forests are worked intensively by the natives, but it will be long before it is possible to work them methodically.

4) *Zone of the argan tree.* - This occupies the shore of the regions of Mogador and Agadir, going up a fair distance in the Souss valley, on the spurs of the Grand Atlas and Anti-Atlas; these forests are from 0 to 150 kilometres distant from the sea and they are scattered in such a way that the area they cover cannot be estimated exactly; it is reckoned at about 300 000 hectares. At present these forests, which prosper on very poor calcareous soils, provide a livelihood for the Cheuls as the oil produced by the argan tree is an important part of their food. In the future these forests would become a considerable source of income for the protectorate, if the argan oil could be extracted commercially.

Argan wood is heavy, compact and very hard; it could only be used commercially for its resistant qualities, but it makes excellent fire-wood and a great deal is exported to Tangiers and Casablanca already for that purpose.

The argan zone is also rich in *Thuja*, used in native cabinet-making at Mogador and which produces, by exudation, the gum sandarac used pharmaceutically as well as in preparing varnish.

476 - **Borneo Forestry (Borneo Timber).** - *The British North Borneo Herald*, Vol. XXXVI, No. 20, p. 191. Jesselton, 1918

Recent explorations by the Forest Department of British North Borneo have revealed the fact that the hitherto little known forest area carries heavy stands of excellent timber so located as to be easy of access from the sea and in all respects suitable for modern steam methods of logging. The area of British North Borneo is 31 000 square miles, of which certainly 90 per cent. is forested. The character of the forests of the interior is as yet unknown, but tracts carrying billions of feet of merchantable timber can be located within 20 miles of the sea. The forests of the north and east coasts carry the most valuable stands of timber. Lowland forests close to the banks of tidal rivers do not as a rule carry as heavy stands as are found farther inland on rising land, where the drainage is better. The finest forests are found on the mountain slopes and on rolling land between the central mountain ranges and the sea. As the high mountains are for the most part not close to the sea, there is an extensive forest of good density following the coast line for 150 miles in the south-eastern part of British North Borneo, and there are indications that a similar forest belt exists along the north-eastern coast.

The export trade in Borneo timber reached its maximum in 1913, when 1 565 989 cubic feet of logs and 162 150 cubic feet of sawn timber were exported, valued locally at £ 98 900. Since 1913 the export trade has fallen off, owing largely to lack of tonnage, but there is every prospect of decided increase in the exports.

In the past over 90 per cent. of all shipments have gone to Hongkong and 62 per cent. of shipments of sawn timber have gone to either Singapore or London. Borneo timber practically dominates the Hongkong market, and, as Hongkong has been able to absorb the greater part of the output, there has been little attempt to place the timber elsewhere.

In spite of the fact that logging operations have been carried on for 35 years a relatively small portion of the timber lands has been cut over. Practically the same primitive methods are in use to-day as when the business started, except that in a few places light 16 lb. rails have replaced forest tracks for hauling timber from the stump to the waterway. Animal or steam logging does not exist in Borneo, though the density of the stand and the topography warrant steam methods. The timber is bucked at the stump into lengths of 16 to 30 ft. and about 70 per cent. of the logs are also roughly squared.

As a rule, an area is abandoned when the timber within two or three miles of the river has been cut; it is generally loaded off directly into the water, bound into rafts of four to six logs, and floated and poled with the outgoing tide to lighters farther down the river. As about 50 per cent. of Borneo timber sinks when freshly cut, it is necessary to provide floaters for the heavier species.

When it is possible to log upwards of 1 500 000 cubic feet of timber per year at a very considerable profit and without the aid of modern equipment, the timber produced must be of high quality. In the order of their importance in the quantity produced the woods that make up 90 per cent of the exports are seriah or serayah or Borneo cedar (1), billian or Borneo ironwood (2) kapur or Borneo camphor, (3) kruin, and selangan batu. Serayah is the equivalent of the Philippine lican; it is a moderately hard, easily worked wood, the lower grades of which are suitable for ordinary construction work, while the better coloured and finished grades are extensively used for first class furniture and as a substitute for mahogany.

LIVE STOCK AND BREEDING.

HYGIENE

- 477 "Mio mio", "Nio" or "Romerillo" (*Baccharis coridifolia*), a Plant Poisonous to Stock in the Argentine. — FLORES C. and HOUSSAY, B. A., in the *Anales de la Sociedad Rural Argentina*, Vol. LII, No. 2, pp. 77-79. Buenos Ayres, February, 1918.

Baccharis coridifolia (fam. Compositae) has often been reported as poisonous to stock and studied from this point of view with discordant results. The authors have reopened the question by undertaking researches at the "Instituto bacteriológico del Departamento Nacional de Higiene" and the "Laboratorio de Fisiología de la Facultad de Agronomía y Veterinaria" of Buenos Ayres, and they have shown that the plant is really poisonous. The stock in the zone where it grows will refuse it; on the contrary, however, stock from pastures where the plant does not exist (especially sheep and cattle) eat it and die in large numbers. So that animals that do not know the plant may learn to refuse it, they are placed in yards and exposed to thick smoke from the plant, or the plant is rubbed on their gums; stockmen say that these methods are successful.

The general symptoms are those of poisoning with predominant nervous symptoms and toxic vaso-motor, secretory and motor disturbances of the digestive apparatus. The toxic doses, in grams of dry matter are:—
by the mouth: cows, 500; horses, 150; sheep, 95; goats, 100 —
intravenous: dogs, 3; rabbits, 1; pigeons, 0.3; frogs, 0.5 —
hypodermic (injection of a sterilised decoction): horses, 50; dogs, 4; rabbits, 1; guinea-pigs, 0.5; white mice, 0.5 —
intramuscular: dogs, 4; pigeons, 0.3 —
peritoneal: dogs, 4.

Curative treatment gives no results, as when the symptoms appear, the poisoning is already deep-seated. In any case, purging is advised.

- 478 — Study on the Diffusibility of the Virus of Rabies. — REMLINGER P., in the *Annales de l'Institut Pasteur*, Vol. XXXIII, No. 1, pp. 28-52 + 3 Tables + Plates. Paris, January, 1919.

The author has studied the diffusibility of the virus of rabies outside the organism and in the organism itself. Brains of guinea-pigs that had

(1) Probably a species of *Hopea* (Dipterocarpaceae). (*Id*)

(2) *Eusideroxylon Zwageri* T. and B. (Laur. ceae). (*Id*)

(3) *Dryobalanops aromatica* Gert (Dipterocarpaceae). (*Id*)

been killed by fixed virus or virus from the street are washed, then placed in sterile LOCKE'S solution or in physiological salt solution. After a few days the liquid, filtered through a Chardin paper, is inoculated under the skin of the stomach or in the neck muscles of the rabbit or guinea-pig: a certain percentage of animals die from rabies. But as the brains putrefy rapidly in LOCKE'S solution or physiological salt solution, it might be supposed that the putrefaction causes the nervous substance to disintegrate, owing to which it would pass into the liquid, carrying the virus with it. This is why, in his researches, the author avoided putrefaction by immersing the brains in glycerine, which has distinctly preservative properties as regards the virus of rabies (ROUX) and found that the virus diffuses more frequently in glycerine than in artificial serum or Locke's solution. Considering these results, the author asked himself whether owing to the diffusion of the virus in glycerine, it might be possible to make it pass from a rabid to a healthy brain. The experiments in this direction gave positive results in about $\frac{1}{3}$ of the cases. Darkness is by no means necessary and the diffusion takes place round the brain of the dog just as well as round that of the rabbit or guinea-pig. A similar passage is observed with the brain of an animal refractory to rabies, such as the fowl or tortoise. The author's conclusion is that the passage of the virus to a healthy brain is *not a culture, but a simple diffusion*, since the virus of rabies can diffuse in the water or glycerine containing an infected brain and impregnate a fresh brain or even a kidney or liver immersed in the same liquid.

Can an analogous phenomenon of diffusion occur *in the organism*? The reply to this question, based on experiments that have been previously reported (1), is that the diffusion of the virus of rabies in the organism is exceptional: in short, diffusion *in vivo* is much less frequent than that *in vitro*.

The property of diffusing *in vitro* in certain liquids and in certain organs leads the author to suggest theories, of the hazardous nature of which he is well aware, on the ever controversial question of the *true nature of the virus of rabies*.

This virus possesses a group of properties whose presence together is paradoxical: at the same time filtrable, diffusible and capable of reproducing itself, it should apparently be considered as intermediary between the visible micro-organisms that are at the lower limits of the plant world and the diastases, colloidal substances that it may not be wrong to place at the upper limits of unorganised bodies. There is a temptation to suggest the hypothesis that the fact of forcing the virus to pass through the pores of a very fine porcelain filter suffices to produce such a modification in its constitution as, without affecting its other properties, causes it to lose that of reproducing the disease, transforming the tiny, ultra microscopic organism that produces rabies into a colloid and thus effecting, in a way, the passage between two worlds. The rabic toxin would

(1) See R., Oct., 1918, No. 117, (141)

thus be a sort of allotropic state of the organism. The author states that this is, apparently, applicable to other so-called "invisible" or "ultra-microscopic" organisms and "filtrable viruses"; and if it were shown that these can also diffuse *in vitro* in liquids and organs, they might be considered as effecting the passage between bacteria and diastases.

479 - **Rats as Agents in Transmitting Ringworm to the Horse.** — KOK D J, in *Ted-schrift voor Dier geneeskunde*, Vol. 46, No. 2, pp. 37-39 + 2 Figs. The Hague, January 1919

The author saw two horses affected with ring-worm (*Trichophyton tonsurans*) in a riding-school; the ringworm was localised in the carpal region, on the head and on the inner side of the thigh. The school had recently been invaded by rats, some of which the author examined to find if they could transmit the parasite. On macroscopical examination a rat was found to have whitish patches and scales on the back and sides, with scabs round the ears; microscopical examination of the skin and hair showed that *Trichophyton* was present.

The author thinks that here an etiological relationship between the infection of the rat and that of the horse must be admitted, especially as all the horses provided with blankets showed the disease only on the limbs and head. He has recorded this fact while waiting until an artificial infection of the rat or horse by a *Trichophyton* confirms his hypothesis.

480 - **Practical Contribution to the Therapeutics of Epizootic Lymphangitis in the Horse** (1). — RUGGERINI C, in *La Clinica veterinaria*, Nos. 1-3, pp. 1-10 and 6, 83, Milan, January 15, 31 and February 15, 1919

Amongst the diseases which, during the war, have been very widely diffused among horses, the second place, after mange, belongs to epizootic lymphangitis in the Italian as well as the other allied armies. The disease has only recently been found to be of parasitic origin, but its contagious nature has been long known.

The author briefly describes the various methods of treatment used up to the present (surgical, chemical, chemico-surgical), then deals with those applied by him to 315 horses, 180 mules and 17 donkeys at the Army Veterinary Hospital at Verona. From the results obtained the following conclusions have been drawn:—

Among all the methods of treatment suggested for epizootic lymphangitis, that which so far seems most preferable consists in combining surgical treatment of the lesions with careful antiseptic treatment. Even cases considered incurable, i. e. forms of farcy with congestion, are curable if the tumours seated in the glandular masses in a relation of dependence with the primitive localisations are removed. There is no need to destroy one by one all the nodules present in the regions peripheral to the swollen glands; the extirpation of the glandular tumours diminishes the swelling

(1) See also *R*, June, 1917, No. 561; *R*, Aug. 1917 No. 734; *R*, Feb., 1918, Nos. 177 and 178; *R*, March, 1918 Nos. 310 and 311; *R*, Sept., 1918, No. 1002; *R*, Dec., 1918, No. 1371; *R*, Jan., 1919, No. 76 (*Ed*)

of the hard nodules and prevents the formation of new ones. At the same time the treatment improves the progress of the wounds already present or derived from abscesses, that are opened after extirpating the tumefied glands; even the diffused congestions begin to be absorbed after the operation, while the other lesions improve and heal.

The extirpation of lymphatic glands affected with slow inflammation by cryptococcal infiltration is fairly easy and not dangerous.

Internal, or general, curative treatment is useful as a reconstituent and general tonic.

Animals suffering from impaired nutrition should be given rich food associated with iodine-arsenical and iron treatment.

- 481 - **Anthelmintic Treatment of Intestinal Strongylosis of the Horse.** — HALL M C, WILSON R H, and WIGDOR M, in the *Journal of the American Veterinary Medical Association*, Vol LIV, N S Vol VII, No 1, pp 47-51. Bibliography of 8 Publications. Baton Rouge La, October, 1918.

Experiments carried out in the biological research laboratories of Messrs. PARKE, DAVIS and Co., at Detroit, Michigan, showed that, contrary to the accepted theory, it is not very difficult to eliminate *Strongylus* from the large intestine of the horse. The most suitable remedy is *Chenopodium* oil (1), which ejects 95 to 100 % of the *Strongylus* if administered to horses which have fasted for 36 hours. The dose should be 16 to 18 cc. given in one or more times, and accompanied or followed 1 to 2 hours later by 900 to 1000 cc. of linseed oil. The small worms (*Cylicostomum*) are more easily ejected than the large ones (*Strongylus*), probably because the second attack the mucous membrane which the first do not. Essence of turpentine was the second best of the remedies tried. Copper sulphate and emetics were of little use.

- 482 - **Nervous Symptoms and the Persistence of Trypanosomes in the Cerebro-Spinal Fluid of Mules Suffering from "Nagana" in East Africa.** — DEGRÉE G, in the *Bulletin de la Société de Pathologie Exotique*, T. XII, No. 1, pp. 17, 21. Paris, January, 1919.

The author describes his observations on mules suffering from "nagana" (a disease caused by *Trypanosoma Brucei* var. *ugandae*) which he made during the course of military operations in German East Africa.

The observations show: - 1) the disappearance of the parasites from the blood and their persistence in the cerebro-spinal fluid during trypanocidal treatment; 2) the existence of symptoms of manifest cerebral excitement in one of the animals treated.

The first fact can be compared with what takes place in a man, infected with *gambiense* virus and arrived at the second period of the disease. *Treatment only rarely succeeds in causing the parasites to disappear from the cerebro-spinal fluid.*

The second fact shows that if, by suitable treatment, the duration of the evolution of the disease in mules infected with *Trypanosoma Brucei* var. *ugandae* is prolonged, in certain animals, apart from the exaggeration

(1) See also R. Oct., 1918, No. 1128. (Ed.)

of the symptoms resulting from nervous medullary lesions, signs of trypanosomic meningism may be seen to come on.

483 - On the Receptivity to Anti-Plague Vaccination of Calves born of Mothers Immune to Cattle Plague; Experiments on Anti-Plague Serotherapy (Kolle and Turner Method) made in Italian Somaliland on Calves before and after Weaning. — CROVERI P., in the *Bulletin de la Société de Pathologie Exotique*, Year XII, No. 2, pp. 65-71. Paris, February, 1919.

Researches carried out at the Serotherapeutic Institute of Italian Somaliland.

According to the theory of immunity (1), vaccination, that is, the introduction of attenuated antigens into the organism so as to produce active immunity by developing a benign disease, has no result when the antigen inoculated cannot fix itself on cellular elements capable of fixing it with their *receptors*, because the antigen has previously come into contact in the circulation with antibodies (*free receptors*) that can fix and destroy it. In other words, vaccination brings about no reaction when the vaccine is inoculated into an organism immunised either actively or passively.

Taking the standpoint of anti-plague serotherapy, it must be admitted that calves born of mothers actively immunised against cattle plague, owing to a previously contracted infection or to vaccination, cannot react to vaccination.

According to the observations of numerous authors, it is evident that in the organism of calves born of mothers actively immunised against plague, there is such an accumulation of antiplague antibodies as suffices to render them passively immune. This state of immunisation, which may disappear rapidly with the growth and increase in weight of the animal owing to the transformation of the antibodies present at the moment of birth, is maintained by the accumulation of new antibodies administered to the young animals in the mother's milk. The natives know that, when the "furux" (native name of cattle plague) is raging, calves fed by an immunised mother ("gurne") are not attacked; this passive immunity disappears when, after weaning, the anti-plague antibodies are no longer introduced into the body of the young animal and as those introduced during suckling are gradually destroyed.

In the very young organism, the intestinal mucosa is very permeable to antigens and antibodies, but afterwards, during growth, as the adult structure is approached, the permeability gradually diminishes and finally disappears; this is why the immunity is gradually lost. Again, while the quantity of anti-plague antibodies administered to the calf by the mother remains constant at first, afterwards diminishing (at the time of mixed feeding: suckling and pasturage), the weight of the calf increases continuously, so that there comes a time when the quantity of antibodies circulating in the blood does not suffice to protect the young animal which then becomes receptive to the disease.

(1) For FERLICH's theory of immunity see note to abstract No. 56 of R January, 1918. (Ed.)

It remained to be ascertained up to what age the calves are immunised by the antibodies that have accumulated in their organism, i. e. at what age should they be vaccinated. To find this out the author carried out a series of experiments at the Merca Serotherapeutic Institute, the results of which, corroborated by thousands of observations made during vaccination campaigns, have led to the following conclusions :—

1) The milk of a mother actively immunised against cattle plague and given to the calf naturally by suckling, confers on it a state of passive immunity which, under normal conditions, still persists when the animal is on the way to be completely weaned.

2) Calves fed artificially, sooner or later leading to the use of milk substitutes, are receptive to anti-plague vaccination.

3) The passive immunity conferred on the calf by natural suckling still persists after complete weaning for a period not exceeding three months.

4) Between the period during which the calf is absolutely immunised and that during which it can react to vaccination by showing the classic reaction symptoms of adults, there is an interval during which the calf is receptive, but the presence of some antibodies still circulating in the blood renders the reaction very weak and often difficult to detect (slight and passing rise of temperature, sometimes accompanied by slight watering at the eyes).

The Somaliland natives usually leave all the mother's milk to the calf for the first two months ; in the third month, one half is taken away and in the fourth month, the calf is completely weaned. The calves should, then, never be vaccinated before 5 months, if they are vaccinated at 7 months, they will be surer to react ; they can be vaccinated between 5 and 7 months, but if, in the 15 days following vaccination, the symptoms of the reaction (prostration, loss of appetite, watering at the eyes) are not plainly manifest the vaccination must be repeated when the 7 months have passed.

484 - **Dromedary Mange.** — SERGENT E., and LHERITIER A., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 2, pp. 91-99 + 5 Figs. PARIS, February 12, 1910.

Mange ("djreb" in Arab), is, after "dadab" (trypanosomiasis transmitted by gad-flies), the worst disease affecting the dromedary in North Africa. The authors are the first, they think, to describe the mite causing camel mange (*Sarcoptes scabiei* var. *cameli*).

The natural course of the disease in animals left without treatment was :— for a few weeks, slow progress, the disease remaining mild ; then a sudden invasion of the entire body, this generalisation of the cutaneous infection usually ending, after 2 or 3 months, by the death of the animal.

Local lesions :— no furrows ; scaly scabs ; hair falls off ; the skin wrinkles, thickens and cracks ; the mite attacks the parts with the most tender skin ; parts most attacked are lips, junction of legs to body, groin ; the part least attacked is the rump.

General symptoms:— itching (violent scratching causing wounds); emaciation becoming extreme (normal appetite is long maintained); œdemata on the limbs before death; cachexy.

Dromedary mange is a serious disease which ends in consumption and death if treatment is not given.

Treatment. — The authors have tried such treatment used for horse mange as could be applied under Algerian conditions to dromedary mange, such as grooming with couch-grass brushes and warm soapy water, application of potash soap for 20 minutes, washing with warm water followed by friction with a couch-grass brush and warm cresylated water (choose a fine day, mild and with sun, without wind, make the animals walk after treatment and give them extra bran). The animals suffered greatly from the treatment and all died a few days after; a post mortem examination showed them all to suffer from pulmonary congestion and pericardiac effusion.

The dromedary is an animal extremely sensitive to wetting; its (rectal) temperature goes down as soon as it is wet; therefore treatment requiring prolonged washing should be avoided. Whilst awaiting the results of further experiments, the best treatment seems to be the application of tar prepared by the natives from *Juniperus phoenicea* and *Thuja articulata*. This treatment is very good, provided it is applied early, completely and repeatedly.

Dromedary mange in man. — Dromedary mange is very easily transmitted to man and may cause serious trouble in subjects with little resistance. The infection lasts from 15 days to several months. Treatment — soaping, friction, HELMERICH pomade, Peruvian balsam, Moorish baths, sulphur baths; these treatments were not successful with men exposed to mass infection.

185 - **The Acid-Base Balance in Animal Nutrition; The Effect of Certain Organic and Mineral Acids on the Growth, Well Being and Reproduction of Swine.** — LAMB, A. R. and EVVARD, J. M., in the *Journal of Biological Chemistry*, Vol. XXXVII, No. 2, pp. 317-318 + 4 Tables. Baltimore, February, 1920.

The best way to determine whether it is necessary to have equilibrium between the acids and bases supplied by a ration is to study the effects of a ration satisfactory from all points of view but having a marked excess of acid elements from a point of view of the growth, well-being, and reproduction of the animals. Pigs were chosen for the experiment because of their great growing capacity which enables them to quadruple their weight in a few months. Moreover, pigs are usually fed on cereals which always contain acid ash, and it is interesting from a practical standpoint to know whether it is necessary to balance their rations with basic elements.

Four lots of two pigs each were given equal quantities of a good basal ration. In addition lots 1, 2 and 3 received during 150 days, sulphuric acid, lactic acid, and acetic acid respectively at the rate of 500 cc. per head daily. The control lot 4 received no acid.

In lots 1, 2, and 3 growth was almost as rapid as in the control lot,

and all the animals were in the same good condition. The organic acids had apparently been completely oxidised in the organism and the sulphuric acid was neutralised without producing any ill effects.

The animals in Lot 1 continued to receive sulphuric acid for several months in order to observe its effects on reproduction. The young pigs generally died after a few days, mostly as a result of accidents or for reasons unconnected with the feeding of the mother. Although these tests were not very conclusive, they showed that a very acid ration does not influence the embryonic development of the offspring. An examination of the milk of one of the sows showed it to have a neutral reaction and to be normal in appearance and smell; it contained a few traces of sulphates, and the serum contained calcium. The urine of this sow showed no traces of glycosuria or albuminuria.

The basal ration, though not exceptional, was good from all points of view, and contained an abundance of protein and minerals; had it been deficient the results might have been different from those actually obtained. It may, nevertheless, be concluded that, if all the necessary elements are present in the ration under satisfactory conditions, it is not necessary to balance the ration from a basic or acid point of view in feeding pigs.

486 - **Net Energy Values of Alfalfa Hay and of Starch.** — ARMSBY H. P. and LUTES, J. A., in the *Journal of Agricultural Research*, Vol. XV, No. 5, pp. 260-286. Washington, November 15, 1918.

The investigations described were undertaken by the Bureau of Animal Industry of the U. S. Department of Agriculture in collaboration with the Institute of Animal Nutrition of the Pennsylvania State College with the principal aim of determining the net energy value of starch as representing the carbohydrates. Alfalfa hay was used as roughage, chiefly to have a mixed ration not relatively poor in protein, but also to compare the results with the many determinations previously made with this fodder.

Seven respiration experiments were made with a pure bred Shorthorn steer by means of the calorimeter. The points determined were:—

a) the digestibility and metabolisable energy (the difference between the total chemical energy of the food expressed by its combustion calory and the chemical energy lost in the faeces, urine, and combustible gases given off in the intestines during digestion) of varying quantities of alfalfa hay and a mixture of alfalfa hay and starch in the ratio 2.5:1; b) the gas given off; c) heat production.

By comparing the periods during which the different quantities of the same ration were administered, the increases in heat resulting from the consumption of food and the net energy value (metabolisable energy less the increase in heat caused by the consumption of the food) was calculated.

The digestibility of the rations (Table I), loss of energy in the urine, and the importance of the methane fermentation increased markedly when the total quantity of the ration was reduced. The increase in loss of

TABLE I — *Digestibility Percentages*

Food and period		Dry	Wet	Organic matter	Protein	Protein free	Crude fibre	Nitrogen-free extract	Liber extract	Total	Carbon	Energy
<i>Alpaca</i> <i>h y</i>												
Period	V, hay consumed 753 g.	57.22	41.74	50.98	66.60	87.15	41.24	70.35	15.66	72.57	56.94	56.73
	VI, " " 613	59.9	40.92	61.42	63.21	89.52	44.07	71.27	8.96	72.64	57.59	57.55
	VII, " " 342	67.47	42.31	62.36	69.54	90.65	44.71	72.04	22.49	73.55	58.61	58.65
	<i>Average</i>	59.11	41.25	60.96	68.23	88.66	42.94	71.00	14.81	72.79	57.50	57.40
<i>Alpaca</i> <i>h y + cattle</i> (251)												
Period	I, food consumed 821 g.	67.86	44.51	70.68	60.04	87.64	39.26	83.11	23.57	62.99	6.04	67.30
	II, " " 799	67.7	48.86	69.00	56.13	88.86	41.85	81.20	21.18	62.0	6.04	65.98
	III, " " 370	70.12	47.42	71.65	61.02	88.7	44.96	83.43	17.81	66.31	6.74	68.57
	IV, " " 248	70.61	48.63	72.17	63.13	88.70	42.80	84.09	11.15	64.68	6.95	68.48
	<i>Average</i>	64.01	46.62	70.61	59.77	88.25	41.49	82.78	20.45	63.71	67.58	67.34
	<i>Average weight of cattle</i>	67.16	45.88	71.17	61.01	88.04	41.35	83.36	20.20	64.07	68.13	67.82
<i>Starch</i> (calculated by the average digestibility of the hay)												
Period	I, " "	92.62	—	92.11	—	—	—	96.46	—	—	93.10	92.78
	II, " "	88.55	—	88.76	—	—	—	91.96	—	—	87.28	88.14
	III, " "	9.48	—	95.03	—	—	—	96.45	—	—	96.45	97.16
	IV, " "	68.39	—	96.80	—	—	—	98.46	—	—	97.48	96.75
	<i>Average</i>	82.98	—	91.83	—	—	—	95.33	—	—	92.74	92.07
	<i>Average weight of cattle</i>	94.55	—	93.61	—	—	—	96.80	—	—	97.16	94.53

* Period III gave abnormal results

energy in the urine and methane produced with the less abundant rations exceeded the decreased loss in the faeces so that the proportion of total metabolisable energy was slightly less than with the more abundant rations. The metabolisable energy of starch was 10 % greater than the average found by KELLNER for 5 experiments; the difference is chiefly due to smaller losses in the faeces. Starch caused the usual depression in the digestibility of other foods (alfalfa hay).

The average increase in heat caused by the consumption of alfalfa was 999 calories per kilogramme of dry matter as compared with 981 calories found for this hay the preceding year, and 1169 calories in six previous experiments with three different samples. The average increase in heat caused by starch was 1692 calories per kilogramme of dry matter, as compared with 1248 calories according to KELLNER.

The net energy value of starch was about 9 % below that calculated by KELLNER's experiments, i. e., slightly more than 49 % (instead of 59 %) of the metabolisable energy utilised by the animal (Table II).

TABLE II. -- *Net energy values per kem. of dry matter (calories).*

Food and period	Gross energy	Loss of chemical energy	Metabolisable energy	Heat increment	Net energy value	Net metabolisable energy %
<i>Alfalfa hay:</i>						
Average	4 331	2 396	1 935	999	999	18.15
<i>Alfalfa hay + starch:</i>						
Average for all periods	4 281	1 951	2 330	1 200	1 130	48.11
Average for periods I, II, IV	4 276	1 928	2 348	1 200	1 148	48.99
<i>Starch:</i>						
Average for all periods	4 105	861	3 244	1 692	1 552	47.84
Average for periods I, II, IV	4 105	777	3 328	1 692	1 636	49.16
KELLNER'S average	4 152	1 101	3 051	1 248	1 803	58.80

487 - **Food Value of Two Cakes made from Seed Teguments on Sale in Holland.** —

DE BRUYN, P. R., in *Cultiva* Year XXXI, No. 360, p. 71. Trich, February, 1919

In Holland two cakes are now being sold made from seed teguments of:— *a*) flax ("lynzaadkafkoek"), *b*) caraway ("karwykafkoek"). The author says these should not be considered as concentrates but rather as coarse food with a food value similar to hay. Their chemical composition (determined at the Royal Dutch Agricultural Station) is for *a*) and *b*) respectively:— albuminoids, 8.2 and 9.4; fats, 5.3 and 2.9; starch, 30.0 and 31.0; crude fibre, 27.4 and 23.3; mineral matter, 15.3 and 18.0; moisture, 13.8 and 15.4 %.

PRODUCTION

- 488 - **The Inheritance of Milk and Fat Production in Cattle.** — GOWEN, J. W. in the *Journal of Agricultural Research*, Vol. XV, No. 1, pp. 1-57 + 6 Plates + Bibliography of 59 Publications. Washington, D. C., October 7, 1918.

At the Maine Agricultural Experiment Station the author made a genetic study of the first-generation crosses of prominent dairy breeds of cattle and beef-bred Aberdeen-Angus. This work was undertaken as a link in the chain of evidence necessary to the final solution of the problems which are connected with the inheritance of milk production and butter-fat production. A cross-bred herd is being formed at the experiment station so as to provide as much material as possible for the analysis of the laws of heredity concerned with the productivity referred to, and this herd has now gone into its second generation.

Some of the results already obtained by the author are the following :

- 1) Black body colour is dominant to the other colours in the first generation. In the second generation an orange coated bull and a dark Jersey dun-coated heifer were segregated out. — 2) White marking of the body, taken as a whole, appears as a dominant. Study of individual white patches, however, indicates that this is true of white in the inguinal region only, for this alone appears as such a dominant. White spots on the face, neck, shoulders, rump, flanks and legs are generally suppressed in the offspring when the white-spotted individuals are mated to solid colour. — 3) Pigmented muzzle is dominant to one not pigmented. — 4) A pigmented tongue is dominant to a non-pigmented one, a confirmation of a previous result. — 5) A black switch appears to cause the suppression of the other switch colours in the offspring. — 6) Some exceptions were found to the previously accepted hypothesis of simple dominance of polledness over horns and it is suggested that a hormone secreted by the testes may have some influence on the presence or absence of horns. Should this prove true, it would establish an interesting parallel between cattle and sheep, for in the latter a sex hormone is known to affect the development of the horns.
- 7) The qualities of beef production are shown to be divisible into four general regions of the body: — head, fore quarters, barrel, and hindquarters. When either parent is of Aberdeen-Angus breed the offspring show the characteristic type of head and heavy, deep fleshed forequarters. The body and hindquarters appear intermediate, but resemble most the dairy parents. From his results so far the author concludes that for the improvement of the beef qualities of dairy breeds the first-generation crosses show an increased value of the beef qualities in the forequarters, without materially influencing the hindquarters. — 8) A few data are supplied as to the production of milk and butter fat by some of the cross-breeds. The results indicate that milk and fat production behave separately in inheritance. High milk production is dominant to low production, but a high fat percentage in the milk is recessive to a low fat percentage.

BREEDING

- 489 - **Breeding in Finland, Morocco and Ethiopia.** — See respectively Nos. 412, 413 and 414 of this *Review*.

490 - **The Martina Franca Donkey (Apulia, Italy).** — LOPERFIDOL, in the *Giornale d'Ipologia*, Year 32, No. 5. Pisa, March 16, 1919

HORSES

The author regrets that the best specimens of this excellent breed of tall donkeys, eminently suitable for the production of mules, are too often lost to national breeding by being exported. Some years ago the Italian Government founded a donkey stud at Luparello, near Palermo, for the purpose of keeping the breed pure and providing good males for the national production. According to the author it was a mistake to start the stud in a region outside that from which the breed originated (province of Lecce), the calcareous soil of which is an important factor in the fine development of the Martina Franca ass. He thinks that the hinnies produced by this breed are better than the mules for they can do pack work in the mountains that the latter could not do.

491 - **Maize Silage in Rations for Fattening Steers; Experiments in Missouri, U. S. A.** — ALLISON H. O., in the *University of Missouri, College of Agriculture, Agricultural Experiment Station, Bulletin No. 150*, 24 pp. + 7 Figs. + 12 Tables. Columbia, August, 1917

CATTLE

The increase in the cost of concentrated foods has led to a tendency to decrease the amount of them used in fattening steers and to increase the amount of roughage. As maize silage is relatively cheap it is well to know its food value. The author proposed to determine:— 1) the possibility of fattening cattle by an extensive use of maize silage without addition of maize; 2) the importance of a high protein concentrate in a ration consisting of shelled maize, maize silage and alfalfa hay; 3) the relative value of linseed oil meal and cotton-seed meal in rations containing maize silage. The first test, with 5 lots of 6 steers, lasted 137 days (from December, 1915 to May, 1916); the second test, with 5 lots of 8 steers, lasted 130 days (from December, 1916 to May, 1917). The steers were of high grade and bought at the Kansas City market; after fattening they were sold at Chicago. The steers were followed by pigs in order to utilise the waste; in the first test there were three pigs, and in the second four, in the lots receiving shelled maize; there was only one in the other lots.

The principal results, given in the appended table, are based on the following prices:—

1st test. — Steers \$7.44 per 100 lb.; shelled maize \$0.70 per bushel; maize silage \$4.50 per ton; cotton-seed meal and linseed oil meal \$37.00 per ton; alfalfa hay \$14.00 per ton.

2nd test. — Steers \$8.25 per 100 lb.; shelled maize \$1.50 per bushel; maize silage \$8.50 per ton; cotton-seed meal and linseed oil meal \$45.0 per ton; alfalfa hay \$15.0 per ton.

CONCLUSIONS. — The results obtained with lots 3 and 4 (without shelled maize) show the possibility of fattening 3 to 4 steers per acre on maize silage without shelled maize. Although the daily gain in live weight per head was less than when shelled maize was added it was nevertheless satisfactory.

The value of adding high protein concentrate to the ration was shown by Lot 4 (linseed oil meal). The net cost of 100 lb. gain in live weight

Results of fattening steers on maize silage with and without shelled maize.

	1st test					2nd test				
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
shelled maize .	15 60	15,24	—	—	15 27	16,71	17,11	—	—	16,62
Cotton-seed meal	2 60	—	5,05	—	—	2,78	—	4,35	—	—
Linseed oil meal	—	2,54	—	5,05	—	—	2,85	—	4,35	—
Maize silage	17,47	16,47	36,22	37,62	16,66	24,74	39,06	47,97	49,41	25,93
A falfa hay.	3,69	2,27	3,00	4,03	3,90	3 25	3,78	5,69	5,82	3,94
Daily gain in live weight per steer	2,72	2,15	1,97	2,38	2,20	3,03	3,26	2,40	2,46	2,04
Gain in live weight per pig per steer . lb	38,16	51,10	— 6,40	3,10	36,33	84,95	106,58	1,78	5,16	66,50
Cost of food per steer	\$ 40,85	\$ 58,63	\$ 6,67	\$ 27,44	\$ 33 58	\$ 86,01	\$ 88,25	\$ 44,79	\$ 45,71	\$ 77,12
Cost of 100 lb gain in live weight per steer (pigs credited with 1,500 per 100 lb gain in live weight in 1st test and \$ 13 00 in 2nd test)	\$ 10,42	\$ 10,58	\$ 10,15	\$ 8,57	\$ 10,88	\$ 19,01	\$ 17,55	\$ 14,28	\$ 14,06	\$ 19,68
Percentage of dressed beef	13,53	14,19	62,38	61,33	62,58	60,60	61,10	59,30	58,40	69,50
Shrinkage per head in transport	48,89	3,41	43,11	39,71	30 00	55,70	0,41	71,25	56,58	4,75
Net profit per steer	\$ 6 77	\$ 9 32	\$ 9,87	\$ 14,58	\$ 10,53	\$ 0,01	\$ 10,07	\$ 11,59	\$ 15,02	\$ 0,52

was lowest in this lot, second lowest in Lot 3 (cotton-seed meal), and highest in Lot 5 (no protein concentrate).

Linsced oil meal gave a greater net profit per steer and a greater daily gain live weight per pig, than cotton-seed meal.

In the first test the difference in price made by the fattened steers when shelled maize was fed was not sufficient to justify its use. In the second test the difference in the price of the steers was sufficiently high to justify the use of shelled maize at \$ 1.0 per bushel and maize silage at \$ 6.00 per ton, but not high enough to justify the use of these foods at \$ 1.50 per bushel and \$ 8.50 per ton respectively.

The results of the two tests show that as a rule it is advisable to add a high protein concentrate to a ration composed of shelled maize, maize silage, and alfalfa hay when fattening cattle.

492 - Preparation of Maize for Fattening Steers; Experiments in Missouri, U. S.

A. — ALLISON H. O., in the *University of Missouri, Agricultural Experiment Station, Bulletin* 149, 35 pp + 11 figs. Columbia, Miss. 1911, August 1917

The experiments described aimed at determining the best form under which maize may be fed for fattening two-year old steers. Three tests were made with a total of 90 two-year old steers. The first was begun in December, 1912, and the last ended in May, 1915. In each test there were five lots of 6 steers, in which Shorthorn blood predominated.

Each group received a basal ration of concentrated protein food, maize silage, and leguminosae hay, and, in addition Lot 1 received broken ear maize, Lot 2 shelled maize, Lot 3 crushed maize and cob, Lot 4 maize and cob meal, and Lot 5 ground maize.

Comparative results of fattening steers with different forms of maize (average of three tests).

		Lot I	Lot II	Lot III	Lot IV	Lot V
Average daily ration per steer	maize kg	7 902	8.065	7 820	7 756	8 314
	concentrated protein food	1 261	1 343	1 247	1 229	1 383
	maize silage	7 974	8 051	7 257	7 534	8 264
	Leguminosae hay	1 129	1 220	1 148	1 080	1 397
Daily gain per steer		1 143	1 229	1 175	1 184	1 397
Gain (of steers and pigs together) per bushel of maize consumed		18 804	18 179	17 090	16 251	17 626
Dry matter fed per 100 lb gain (of steers and pigs together)		21 63	16 02	10.63	4 98	4 56
Percentage of total gain (of steers and pigs together) credited to pigs %		762 44	842 31	877 78	936 42	873 38
Net cost of 100 lb gain of steers (deducting the value of the pork produced) . kg		105 22	110 02	119 59	128 42	117 11
Loss in weight per steer in transport . . kg		14 956	15 676	12 365	14 129	16 745
Profit (+) or loss (—) per steer fr		+ 20 73	+ 14 77	+ 4 92	— 6 06	+ 12 54

The concentrated food was pressed or crushed cotton-seed cake. In the first and third tests alfalfa hay was given, in the second, clover hay. The ratio of shelled maize to cake was, as far as possible, kept at 6:1.

Pigs weighing from 100 lb to 125 lb followed the steers to use up the waste, which would otherwise have been lost. In Lots 1 and 2 there were four pigs, three in Lot 3, and two in Lots 4 and 5. The number of pigs was not the same in every lot because the amount of available waste differed. The first and third tests lasted 130 days, the second 135 days.

Lot 5 (ground maize) sold at the highest price per lb. of fattened animal, followed, in order, by lots 4 (maize and cob meal), 2 (shelled maize), 3 (crushed maize and cob), and 1 (broken ear maize). Lot 1 and 2 (as shown by the consumption of dry matter per lb. of gain) utilised the maize (broken ears and shelled grain respectively) more economically than the other lots receiving ears or grains crushed in varying degrees. The higher sale prices per unit of weight realised by these last lots were not sufficient to compensate for the smaller gains per unit of food consumed and the cost of preparing the maize.

493 - Sunflower Silage for Dairy Cows; Experiments in Montana, U. S. A. —

ARNETT C. N. and FRIEDT-VELO in the *University of Montana, Agricultural Experiment Station, Bulletin 118*, pp. 75-80, Bozeman, September, 1917

The giant sunflower of Russia, sown at the Montana Agricultural Station in the spring of 1915 yielded, when irrigated, 36 tons per acre of green fodder which, when fed to dairy cows, either simply chopped or siloed, gave excellent results. The following year sunflowers, hoed but not irrigated, yielded 22 tons per acre of green fodder. The cows ate from 40 lb. to 90 lb. a day of young sunflower (representing about 5% of the plant in flower) which proved to have a food value almost equal to that of maize fodder. To determine the food value of siloed sunflower two lots of 7 cows were subjected to feeding tests. Lot 1 received concentrates (oats, malt sprouts and bran in the ratio 5 : 2 : 3) and alsike clover hay. Lot 2 received the same ration except that part of the clover hay was replaced by siloed sunflower. At the end of 28 days the rations of the two lots were reversed and the experiment continued for a further 28 days. The results obtained were :—

	Lot I lbs.	Lot II lbs.
Initial average weight	1 072	1 081
Final average weight	1 083	1 087
Average gain in 28 days	11	6
Average daily consumpt. { of concentrate	13	13
{ of clover hay	21	12
{ of sunflower silage		34
Average daily milk yield per cow	33.37	31.35
Average daily fat content of milk per cow	1.382	1.150

Thus, a daily consumption of $3\frac{3}{4}$ lb. of sunflower silage resulted in a saving of 1 lb. of clover hay and, at the same time, increased the milk and butter yields. The products had no peculiar taste or smell.

494 - Silk worm Chrysalid Meal as a Food for Dairy Cows; Experiments in Italy.

1 -- PIROCCHI A., in *L'Agricoltura italiana illustrata*, Year I, No. 2, pp. 65-67 Milan, February, 1919

Chrysalids are one of the by-products of silk spinning-mills, the amount of which available each year is estimated at about 60 000 quintals in Italy. They are used almost exclusively as manure (especially for growing rice and flowers) for which they are employed under one of the following forms. -- a) preferably in the state in which they leave the spinning-mills; b) dried; c) after the oil has been extracted by benzene or carbon bisulphide. The average composition of whole chrysalids dried commercially is, in percentages: - nitrogen, 9-9.50; phosphoric acid, 1.7-1.8; potash, 1-1.10; ash, 5-5.5; moisture, 10-20%. The oil, of which the chrysalids contain from 16-18 %, has 20 % and more of free fatty acids and is used for making inferior qualities of soap. The amount of chrysalids available in Italy could furnish 9 000 to 1 000 quintals of oil, but the quantity of oil actually extracted does not even reach half that figure.

In Italy, the chrysalids are also used, though to only a limited extent, as cattle food; in some localities they are fed fresh to pigs, especially for a few months after weaning, but not later, as the meat and fat would acquire an unpleasant taste and smell; they are also given to poultry, either alone or mixed with other food. In Japan this by-product has been tried in feeding carp (*Bulletin de l'Association sericicole du Japon*, 1903, No. 136). These few uses quite suffice to show how the chrysalids could be used for manuring, not directly, but indirectly, that is after the stock have digested them. Chrysalids with the fat removed contain 65-66 % of crude protein, about half of which is digestible; in some chrysalid meal very carefully prepared by Dr. COLOMBO (of the Experimental Laboratory for the Study of Silk, at Milan), there was 68.25 % of crude protein, 59.5 % of which was digestible. But the chrysalids sometimes undergo changes that may end in putrefaction, with the formation of poisonous substances, and stock refuse them. To avoid this, Dr. COLOMBO recommends that the fat should be removed, the chrysalids treated with water acidulated with hydrochloric or sulphuric acid, then dried and crushed; in this way is obtained a dark red meal with a strong, but not repugnant odour.

After making certain that the chrysalid meal is suitable for use in feeding cows, horses and rabbits, the author tried an experiment in order to ascertain: -- a) whether chrysalid meal can replace linseed cake in feeding dairy cows and to what extent; b) what influence chrysalid meal has on the health, live weight, the yield and quality of the milk; c) if, compared with linseed cake, the use of chrysalid meal has any economic advantage in feeding dairy cows.

The experiment included three periods: 1) of 15 days, during which the food consisted of hay from a water-meadow (*marcila*), May hay and linseed cake; 2) of 20 days, during which the linseed cake was replaced by a mixture, in equal parts, of chrysalid meal and rice bran ("pula" or "farinetta di riso"); 3) of 15 days, with the same ration as the first period. It was found that 1.5 kg. of the above mixture was equal to 1 kg. of linseed cake.

In the second period most of the cows had an increase in live weight of from 2.7 to 9 kg.; one cow lost 1.15 kg. The milk remained fairly steady during the three periods, in the second, there was no change in its properties.

CONCLUSIONS — Silk-worm chrysalid meal properly treated can, when mixed with rice bran, replace linseed cake in feeding dairy cows, without any disadvantage from the physiological point of view, for it had no injurious influence on the health, weight, quantity and quality of the milk of cows used in feeding experiments with chrysalid meal; from the economic point of view it proved more advantageous than feeding with linseed cake.

As the disagreeable smell of the chrysalid meal is also very probably related to the beginnings of putrefaction (to which the cocoons are subject in the spinning mills), this defect must be eliminated by emptying the cocoons as soon as possible, rapidly drying the chrysalids which should be extracted for their oil and given the special acid treatment, or by some other suitable method.

To replace ordinary cakes by silk-worm chrysalid meal (which differs notably from them as regards chemical composition), it should be mixed in equal parts with rice bran; 1 kg. of linseed meal was shown to be equal, for food value, to 750 gm. of chrysalid meal + 750 gm. of rice bran.

To make chrysalid meal mixed with other foods, preferably in the form of mashes, more appetizing, some condiment should be added, such as salt (30 gm. per mash), molasses, etc.

POULTRY

495 — **Some External Parasites of Poultry and How to Control Them, in the United States.** — MORE D. C., in the *Ohio Agricultural Experiment Station, Bulletin No. 320*, pp. 139, 156 + 15 Figs. Wooster, December, 1918.

This Bulletin gives a concise description, for the use of practical poultry keepers, of ectoparasites of poultry found mostly in Ohio, with the exception of a few which have not yet been reported there. In addition to the ectoparasites previously described by F. C. BISHOFF and H. P. WOOD in the *Farmers' Bulletin* 801 (1), the author mentions: — Bird mite (*Dermanyssus hirundinis*), harvest mites (*Trombidium* sp.), scaly leg mite (*Cnemidocoptes mutans*), depluming mite (*C. laevis* var. *gallinae*), stick tight chicken flea, or southern chicken flea (*Echidnophaga (Sarcopsylla) gallinacea*), European hen flea (*Ceratophyllus avium*), bed-bug (*Acanthia lectularia*), cucuko, or Mexican chicken bug (*A. inodora*), and barn swallow bug (*A. hirundinis*).

The control measures recommended are: Against the small body louse (*Menopon trionocephalum* [*M. pallidum*]) and the large body louse (*M. biserialatum*): gasoline 3 parts, crude 90-95 % carbolic acid 1 part, and plaster of Paris as much as the preceding liquids will moisten. Mix, leave to dry, and keep in hermetically sealed bottles. The powder should be dusted on.

(1) See R. Sept., 1917, No. 830 (*Ld.*)

Against the head louse (*Lipeurus heterographus*), 50 % mercurial ointment ; so that it may be more easily applied it is mixed with double its quantity of vaselin or lanolin.

Against red mite, poultry mite or roost mite (*Dermanyssus gallinae*) and bird mite, thorough and frequent application of a good insecticide. In washing the hen-house (dropping boards, floor, ceiling, perches, nests) good results are obtained with the following solutions :— 1) a mixture of 3 parts of paraffin and 1 part of 90-95 % carbolic acid, or 3 parts of paraffin and 1 part of cresol ; 2) cresol disinfectant prepared as follows — 3 ½ quarts of crude linseed oil are put in one dish and, in another, 1 lb. 6 oz. of commercial soda which is dissolved in as little warm water as possible and left to cool. The soda is then poured very slowly into the linseed oil, stirring meanwhile and mixing well for ½ hour till a liquid soap is formed : 8 ½ quarts of commercial cresol are then added very slowly. For use this mixture should be diluted with 5 % of water ; 3) kerosene emulsion :— ½ lb. of hard soap is dissolved in 1 gallon of water by slowly boiling, 2 gallons of kerosene added and the whole well mixed. The emulsion is used with six times its quantity of water ; 4) sulphur-lime mixture used for the winter spraying of plants.

Against harvest mite :— As a preventive measure spray on sulphur ; touch the lumps on which the mites are with a feather dipped in petroleum or benzine ; keep the infected birds in a sunny enclosure without grass — sun is fatal to these parasites.

Against scaly leg mite :— loosen the scales which form on the legs and feet of the fowls by dipping in warm water for a few minutes, remove the scales and apply an insecticide :— 1) caraway oil + four times its quantity of lard or vaseline ; 2) 1 dram of flowers of sulphur, 20 grains of potassium carbonate, and ½ oz. of lard or vaseline (sulphur-ointment or SALMON'S ointment) ; 3) 1 part of kerosene and 2 parts of crude linseed oil.

Against depluming mite :— 1) caraway oil ointment ; 2) SALMON'S ointment ; 3) Peru balm ; 4) creoline + 10 times its quantity of lard or vaseline ; 5) crude oil, or a good coal tar.

Against southern chicken flea :— clean and disinfect the chicken run. The parasite is prevented by keeping cats and dogs away and killing the rats and by laying down abundant salt and watering 2 or 3 times a week ; this treatment makes multiplication of the fleas impossible. Direct treatment of the fowls is not always satisfactory. It is advisable to apply, to the infected parts only, the following mixtures :— 1) 1 part carbolic acid and 2 parts vaseline) ; 2) 1 part kerosene and 2 parts of vaseline or lard or one of the previously described insecticides.

Against European hen flea :— the same treatment as against red mite.

Against bugs :— 1) burn sulphur in the hen house if it can be hermetically closed ; 2) spray with ⅓ gasoline and ⅔ of coal oil ; 3) the same treatments as those recommended against mites.

- 496 - **Sweet Corn as a Poultry Food.** — CALDERON H, in *La Revue Agricole*, Year XXIX, No. 3, pp. 20-21. Paris, March, 1919

The variety of maize called "sweet corn" in the United States and catalogued in France by seed-merchants as "*maïs nain blanc très sucré, très hâtif*" (dwarf, early, sweet maize), and already used as a vegetable, both preserved green and under oil, is also a first class poultry food.

RICHARDSON gives its percentage composition as: - water, 8.44; fat, 8.57; protein, 11.48; nitrogen-free extract, 66.72; fibre, 2.82. If these figures are compared with those given in MALLÈVRE's tables for ordinary maize, it will be seen that sweet corn contains $\frac{1}{3}$ less water, 1.38 % more of protein and double the quantity of fat. Valued by the sum of its nutrients (77 %, against 68.6 % for ordinary maize), it is worth at least 13 % more than ordinary maize.

As the food value of ordinary maize is 33 % higher than that of oats and as the yield is from 25 to 50 % higher, it may be admitted that if 1 hectare (2.47 acres) of oats will provide keep for a year for 30 fowls, then 1 hectare of maize could maintain 40 or 50. Under climatic conditions like those around Paris, this early, dwarf maize would have the advantage of being sown at the end of May, a time when no other seed can be sown; it comes well after a crop of rye grown for fodder or after crimson clover. At the end of three month's growth, it gives out its first green ears, which ripen completely in 2 or 3 weeks.

- 497 - **A Quick Method of obtaining accurate Individual Egg Records without the Trap Nests.** — ADDER B. in *Bulletin of the Utah Agricultural College Experimental Station Bulletin* No. 162, 12 pp. + 2 Figs. Logan, April, 1918

In the method described the hens are shut in the hen-house and visited every morning a little before sunrise, the hens are examined by touch and those which will lay during the day registered. The examination is made externally by slightly pressing the finger at the side of the abdomen, over the pelvis bone and near its end. The hens are seized one by one at the small exit of the hen-house. At the Utah Experiment Station 2 men examined 500 hens from 16 houses in 27 minutes. In 1915, by this method, of 42 886 eggs laid at the Station, only 0.5 % were not registered. In a test comparing this method with that of trap nests 308 eggs were registered and 307 actually laid, 19 outside the trap nests. In another similar test 259 eggs were registered, 251 laid, and 15 laid outside the nests.

The method recommended is most simple, requires no apparatus, may be adopted by all, and is more healthy for the hens, which are not obliged to remain several hours in the hot, often badly ventilated trap-nests. It also facilitates the elimination of bad layers, thus increasing the profit made by the hen-run.

BEE KEEPING

- 498 - **Bee Keeping in Morocco.** — *L'Abeilleleur*, Year 63, No. 2, pp. 32-33. Paris, February, 1919

Information supplied by the Resident General.

Few data are as yet available on bee-keeping in Morocco, as the api-

cultural resources of the country are only just becoming known. Bee-keeping is carried on exclusively by natives, who obtain important amounts of wax and honey by primitive methods.

The honey is consumed locally as the natives are very fond of it. The crude wax however is exported, the quantities of wax exported by the ports in the French zone since 1911 have varied from 114 138 kg in 1913 to 291 865 kg in 1915, which corresponds to values of 393 000 and 1 006 934 francs. Before the war most of the wax went to Hamburg.

The chief regions producing honey and wax appear to be the Doukkala region and especially that of Haha-Chiadma, the back country of Mogador. Nearly half of the total exportation from Morocco passes through the port of Mogador.

The native bee is small and similar to that of Tunis and Algeria; it is active and has a fairly pronounced tendency to swarm.

The native hives consist either of tree trunks placed horizontally, wooden lattice cages or baskets like the classical hive. The rich natives in the towns sometimes own hundreds of hives, which are looked after by a *klamme* (man with an interest in the produce), the yield from these hives, exclusively reserved for consumption by the owner and his numerous servants, is usually low, it rarely attains 5 kg of honey per hive.

On account of the strong sea breezes, the coast of western Morocco does not seem very suited to intensive, rational bee-keeping. The wild plants (*Cruciferae*, *Liliaceae* and *Leguminosae*) are so plentiful after the rainy season as to transform the sandy soil near the coast line into a veritable carpet of flowers, but the dry summers cause all this vegetation to disappear by July. Nectar from *Labiatae* (*Thyme*, *Rosemary*), used in autumn by the Tunisian bees, does not exist in this region of Morocco. An experimental hive, provided with frames, and installed at the Rabat Experiment Garden, did not give, for this reason, such good results as the hives installed in Tunis, in spite of the care of an expert bee-keeper.

The regions particularly well favoured with regard to the abundance of irrigation water appear better suited for bee-keeping. In fact the flowering season is longer there owing to the humidity, due to the irrigation furrows. This is the case with the regions bordering on the Atlas, and, generally speaking, with all the high lying districts provided with sufficient water.

The well-watered regions round the towns of Meknes and Fez, covered with shrubby vegetation, which remind one of certain European landscapes, would probably be suited for the installation of properly-managed bee-farms, which, owing to the fairly high price of honey (2.50 to 3 francs the kg), would pay well.

The colonists in these regions should, therefore, be advised to increase the income from their farms by bee-keeping, but it would not be prudent to assume from the above considerations that an establishment dealing exclusively with bees would at present find such conditions in Morocco as would enable it to prosper.

499 - **Bee-Keeping in Large Towns.** — *La Hacienda*, Vol. XIV, No. 4, p. 110 + 2 Figs. Buffalo, N. Y., January, 1919.

Terraces or roofs of large houses in towns might contain one or more hives; the workers could forage in parks, 'public gardens, etc. The most important thing is to choose a suitable breed, which should not be irritable. Swarming should be avoided and the bees not disturbed unnecessarily. Two photographs appended to the article show hives established (up to two dozen at a time) on the terraces of large houses in the very heart of New-York.

500 - **The Work of the Royal Station of Experimental Sericulture at Padua, Italy.** — FIGORINI L., in *La Scienza per tutti*, Year XXV, No. 5, pp. 66-80 + 13 Figs. + 1 coloured Plate. Milan, 1918.

Pebrine first appeared in 1845 in Vacluse (France), whence it spread rapidly throughout all the silk-rearing countries, first in Europe, then in Asia. The gravity of the disease necessitated a series of researches which led to the discovery by CORNALIA (1856) of the corpuscles that bear his name; VITTADINI (1850) discovered that "eggs laid by healthy moths, even when subjected to all kinds of injury, always gave worms free from the said corpuscles"; CANTONI (1862) examined the moths microscopically to obtain healthy eggs from the healthy moths; this method was later adopted by PASTEUR (1865), after whom it was named. The necessity was then recognised of founding special institutes for the exclusive study of sericulture. Austria began by founding the I. R. Institute of Experimental Sericulture at Gorizia in 1869. In Italy, the Minister of Agriculture at first ordered that researches on sericulture were to be carried out in several "Stazioni di prova" (Experiment Stations); then the decree of April, 1871 provided for the foundation of the Institute that afterwards became the "R. Stazione Bacologica sperimentale di Padova" (Royal Station of Experimental Sericulture at Padua), which was to: — "study the essential conditions for the successful culture of silkworms; study the laws of normal nutrition of the worms by means of physiological and chemical experiments; ascertain the causes of the various diseases of the silk-worm and the mulberry; produce and distribute healthy silk worm eggs and examine eggs and even moths for private breeders; test new varieties of silk-worm and new sericultural instruments; undertake any studies or experiments that might prove useful to sericulture; propagate, by writings and conferences, the results of the experiments carried out and practical methods of sericulture; collect information on sericulture in Italy and favour its development with the help of Agricultural Committees and private rearers".

Industrial establishments were created for providing eggs by means of strictly scientific methods; "Sericultural Observatories" were founded as branches of the Padua Station, and the number of agricultural committees and travelling teachers of agriculture was increased. Some of the above-mentioned aims, such as the preparation and distribution of healthy eggs, the examination of eggs and moths, and propaganda, became secondary aims of the Station which took on more and more the charac-

ter of a scientific experiment Institute with a school annexed for preparing the technical staff.

As director of the new Padua Institute Prof. A. VIERSON was nominated in 1871; he had previously, in 1869, cooperated in organising the sericultural Institute at Gorizia. The scientific work of the Institute bore on the morphological and biological problems of the silk-worm and mulberry tree, formulated and treated as problems of pure and applied science; the work was extended to silk, considered as a product of the physiological activity of the worm and as a textile. Some researches of the first groups concern the silk-worm organism considered generally.

QUAJAT analysed the mineral components of the cocoons and chrysalids; besides physiological questions, he also studied technical questions and sometimes found aluminium present in the mulberry leaf. VIERSON and QUAJAT gave a very useful series of figures determining the intensity of the respiration of the eggs, larvae, chrysalids and moths of the silk-worm; PIGORINI, applying statistical methods, determined the distribution of the weight of individuals reared under normal and abnormal conditions. Other researches concern the organs of the insect: the digestive apparatus has been examined regarding its chemical and mechanical functions. VIERSON after finding that the "gastric" juice has an alkaline reaction, remarked on the curious potash content of the juice and found that its reactions changed in the disease known as "flicherie". PIGORINI determined the time that ingested substances remain in the intestines and, for the first time for insects, he analysed the intestinal movements and traced them. QUAJAT and JORDANOFF have studied the food value of different species, varieties and qualities of mulberry leaf, and have found that *Machura aurantiaca* (Moraceae), the bow-wood or Osage orange, is very suitable for feeding the silk-worm.

The minute heart of the silk-worm has been the subject of the researches of PIGORINI who, pushing the graphic method to its utmost limits, has obtained cardiograms of healthy and diseased worms, and has found, in the functions of that organ, a certain independence of the central nervous system and the vitality and persistence of the functions in detached segments. These researches enabled him to observe that, if, on the one hand, the blood of the worm is very acid, on the other, the organs when removed and placed in physiological solutions die rapidly when small quantities of acid are added. As regards the functions of the nervous system, PIGORINI has accurately described a reflex movement of the abdominal claws.

The silk secretion was studied by PIGORINI who, through certain considerations of a chemical and physiological nature, has put forward the hypothesis that it should be considered as an excretion product by which the organism rids itself of special substances (containing an ammoniacal residue) which, if circulating in excess, would poison the insect. The same worker has inquired into the relations that control the characters of the cocoon as a function of the space available for the worm to spin it in, he concluded that, while certain characters (form, diameter, volume) which

depend on the dimensions and morphological characters of the larva remain fixed, others (amount of floss, roughness of surface, hardness) vary, and are those that depend on the difference of the work imposed on the worm by the space in which it works.

Numerous technical experiments have been made on silk. Thus QUAJAT dealt with the influence of water on spinning; he concluded that, as regards tenacity and elasticity, the influence is less than that of the way of spinning and certain other conditions, such as the difference of rapidity in drying the thread. The same author also worked on the physical properties of silks from Italian cocoons and arrived at the conclusion that they can always compete with the majority of the world's cocoons and often surpass them. He also dealt with the relations between the number of floss employed and the physical properties of the thread made from it, as well as apparatus for studying the physical properties of silk; the construction of the Desuzeau basin and of the serimetre was modified under his direction.

PIGORINI has worked on the gelatinising property of the soluble part of the silk, or "sericine"; and, as a result of some successful experiments, he proposed to extract the sericine from the waste water of spinning-mills for industrial use.

VERSON and QUAJAT have studied technical questions relating to cocoons: — rust, various methods of storing, loss in weight of stored cocoons, injurious influence of fumigation (chlorine, sulphurous acid) in rooms where the "heath" is prepared.

Not only has the organism been studied independently but also in relation to its environment:

VERSON and QUAJAT have studied the effect of high and increasing temperature on rearing. A series of researches continued for over 20 years by VERSON helped by BRISSON, deal with the influence of external conditions of rearing on the physical properties of the cocoon. Taking as a starting point the fact that the characters of a breed depend closely on the environment, VERSON studied cocoons chosen from 24 of the best breeds of silkworms, and coming from different local environments from the Alps to Sicily. From the results "it can be said that if care were always taken to adapt each product to the special exigencies of the place of origin with which it is intimately connected, the most celebrated native breeds of past times would be almost spontaneously reconstituted in a few dozen years".

The above studies are more or less connected with those on breeds and crosses as well as those on different silk-yielding bombyces, mostly carried out by QUAJAT. The work dealing with foreign breeds — Chinese, Japanese, Persian, Korean — took into account all those problems of interest both to breeder and spinner, such as: — number of eggs in a given weight of "seed"; duration of larval period; strength and weight of cocoons; quantity of silk they yield; characters of that silk. From each of these studies their author has drawn a definite conclusion, by advising or not the relative rearing, whether as a pure breed, or for crossings, and by indicating each time if there were any value or not, for the rearer and for the spinner. QUAJAT also studied experimentally the chief pure and crossed

breeds of the mulberry bombyx, publishing his results as a monograph under the title "*Dei bozzoli più pregevoli che preparano i lepidotteri setiferi*."

As regards the pathology of the silk-worm, of special interest are: — the studies on "flacherie" (causes, forms, heredity, selection, means of defence); a long and definitive series of researches by QUAJAT, helped by ROSSINSKI, on the biology of *Botrytis bassiana* (the hyphomycete causing "pebrine") and the means of protecting rearings from it; the new researches on jaundice which, suggested by recent observations of GHIRLANDA and connected with some old notes by VERNON, have enabled the two authors to find a clear explanation of the formation and development of the characteristic polyhedric granulations in larvae affected with jaundice.

The study of the mulberry has not been neglected. Thus, VERNON and QUAJAT began researches in 1874 on the chemical composition of the leaf in spring and autumn, dealing especially with the mineral constituents and showing the way they vary during the ageing of the leaf. The same authors worked on the respiration of the detached leaf and showed that it eliminates a considerable quantity of carbon dioxide when in the dark and a much smaller amount under the action of light. Mention should also be made of a study by QUAJAT on the action of various salts and manures on mulberries that were germinated and grown in nutritive solutions and in soils of known composition. PIGORINI has compared the chemical composition of healthy mulberry leaves with that of leaves from trees heavily attacked by *Diaspis*, thus showing the differences; he also demonstrates for the mulberry the well-known phenomenon of the accumulation of complex organic substances in the leaves in sunlight and he has studied the others organs of the plant, giving some new information as to the composition of branches of different ages. GHIRLANDA has dealt with pathological phenomena observed in recently imported Chinese mulberries, finding a parasite which constitutes a new species of microscopic fungus belonging to the genus *Phoma*.

The scientific work of the Station has been published in a series of volumes: — the "*Atlante del filugello sano e malato*" by E. VERNON; the "*Annuario della R. Stazione Bacologica sperimentale di Padova*", the "*Bollettino di Bachicoltura*", etc. In 1897, VERNON and QUAJAT collected into one volume, entitled "*Il filugello e l'arte sericola*" such of the papers, well checked and of indisputable value, as they had at that period relating to the silk worm, the mulberry and silk.

The Station Museum contains: — a collection of about thirty species of wild silk-worms (*Lasiocampa olus* of Asia Minor, the Balkans, Dalmatia and Southern Italy; *Antherea mylitta* from India; *Caligula japonica*; *Rhodia newera*; *Cricula trifenestrata* of Assam and Burma; *Eucheria socialis* of Mexico, etc); a collection of forms now reared in India in the domestic state: *Bombyx textor*, *B. croesi* (probably only a polyvoltine form of *B. mori*), *B. fortunatus*, *B. arracanensis*; the whole series of the cocoons and silks furnished by *B. mori* (that of the different cocoons occupies 2000 jars); a series of large plastic models of the healthy and diseased silk-worm modelled by LUZIARDI under the direction of VERNON.

The Station at Padua has given an impulse to Italian sericulture :

1) by its annual course of instruction aiming at a) communicating the results of scientific researches to rearers in such a way that the resulting rules can be applied by them to practical rearing ; b) training technical rearers and egg producers (since its foundation over 1200 diplomas have been granted by the Institute) — 2) by founding some 60 sericultural " Observatories " entrusted with a) helping, by their advice, to improve sericulture, b) making microscopical examinations of eggs and moths for the rearers in the district ; c) undertaking annually a model rearing and, in time, preparing sound eggs ; 3) by combating the importation of foreign eggs, especially Japanese ones, and that especially by showing practically that, by means of scientific methods, eggs of superior quality can be obtained from the native race — 4) by taking part in numerous exhibitions — 5) by carrying on thousands of microscopic analyses — 6) by organising prize competitions for mulberry plantations, joint incubation chambers, rearing experiments in the elementary schools, etc. — 7) by actively working for the rebirth of sericulture in Southern Italy.

501 - The Formation of Silk Threads. — *Revue générale des Sciences*, Year XXX, No. 2, p. 36. Paris, January 30, 1919

Results of researches carried out by E. HIRAZUKA at the Sericultural Station at Nakanu (Japan) on the formation of silk threads.

The liquid silk stored in the gland of the silk-worm is composed of at least two colloidal substances in suspension in a non-albuminous fluid. The transformation of the liquid silk into solid silk appears to be a process of coagulation. If a certain quantity of the liquid is preserved, it coagulates spontaneously and the process is greatly accelerated by mechanical action (tension, compression) or by adding a trace of acid, even carbon-dioxide. Heating to boiling point also causes coagulation and as it also takes place in the presence of potassium cyanide, coagulation does not appear to depend on enzyme action.

Mr. HIRAZUKA thus considers liquid silk as a concentrated emulsion of silk-forming substance in an unstable, supersaturated state, while solidification is a physical process. By extending movements the liquid silk can be stretched in a semi-gelatinous filament which, when carefully stretched further, coagulates and forms a thread apparently the same as that spun by the silk-worm. It should be noted that, during natural spinning, the silk-worm moves its head constantly from left to right, which puts a tension on the silk issuing from the spinneret.

FISH CULTURE

502 - Artificial Hybrids between Pike and Pickerel, in the United States. — FIMBODY G. C., in the *Journal of Heredity*, Vol. IX, No. 6, pp. 253-256 + 2 Plates. Washington, October, 1918

Investigations made in the Lake of Cayuga, New York, showed fish with characters intermediate to those of pike (*Esox lucius*) and pickerel (*Esox reticulatus*), and the author attempted to determine whether these were crosses between the two species. He found that crosses between these two species are not only possible, but also unavoidable, because

they spawn and fertilise their eggs at the same time and in the same places. In March, 1917 he succeeded in making the cross artificially by fertilising *Esox reticulatus* eggs with the milt of *Esox lucius*; 70 % of these eggs developed normally. At the end of 6 months the author took three of the best developed young crosses, 15.2, 13.8 and 9.1 cm. long respectively and examined their characters, comparing them with those of the parents.

Distinctive characters of Esox lucius. — a) skin covered with irregular dark marks on a darker ground; b) scales covering all the cheeks, but only the upper half of the opercula.

Distinctive characters of Esox reticulatus. — a) skin with a very regular dark chain design on a lighter ground, b) scales covering all the cheeks and all the opercula.

Characters of the crosses. — As these were still very young the character of the skin was not sufficiently developed to make definite criticism possible, but on comparing them with specimens of *Esox lucius* and *Esox reticulatus* of about the same age, this character might be said to be intermediate to that of the two parents. The opercula were however, distinctly hybrid in character; the lower part was not entirely bare, as in *Esox lucius* nor entirely scaly, as in *Esox reticulatus* but $\frac{1}{3}$ of it was covered with scales.

CONCLUSION. — The crosses obtained artificially by the author appear identical with the specimens with intermediate characters found in the Lake of Cayuga, thus confirming the hybrid origin of the latter.

FARM ENGINEERING.

503 — **Economic Conditions of Power Farming.** — TONY BALLU, in the *Annales de la Science agronomique* Year XXXV, Nos 1-3, pp 57-100 Paris, 1918

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

Power farming appears more as an agricultural necessity of modern times than as a simple improvement owing to 'the need for «doing better». Above all it is the simplest true remedy against the too real crisis in labour. Again, it should be remembered that we now live in an atmosphere of intensivity and «mechanisation» which modern agriculture cannot avoid. Power farming is one of the new obligations of intensive farming; it is, says the author, a condition which will perhaps be the modern «necessary evil». This necessity, which was more and more felt before the war, has become the painful question of the hour in those countries that have suffered from the war, especially in the devastated regions.

All the mistakes made in power farming are due to the fact that the inventors and makers of power farming machinery were not sufficiently well acquainted with agricultural science and did not know how to adapt mechanics to the needs of cultivation. The author considers the economic conditions which any power farming machine should obey and thus enters into the field of farm management, which is derived from agricultural practice.

The best "mechanical" solution of the problems of mechanical cultivation and cultivation in general would be to have a special machine for each kind of work. This solution may be said to be found, for there are excellent machines suitable for definite classes of work (windlasses for digging-work, 20 to 40 H.P. tractors for average ploughing, small tractors of the MESMAY type for light work, cultivators of the MEYENBOURG type for breaking up the soil in spring, etc.). But were all these machines to be used on one farm, even of great extent, it would mean financial collapse owing to the depreciation, as each of the machines only works for a short period in each year. From the economic point of view the ideal would be the "single" solution, representing a limited depreciation, the depreciation on one machine being the smaller the more it is used. It is advisable, therefore, to procure machines having varied uses and which can do the most yearly work. At the present moment, *tractors* and particularly, windlass-tractors (e. g. BAJAC, etc.) and wagon-windlasses, best supply the want. The future solution seems to be *electrical*, a regional central station distributing current along the chief communal lines from which branch lines that supply electric motors.

The economical use of power farming also depends on the area and the form of the divisions of the farm. There is no need to exaggerate the difficulties met with by motor-culture in farms that are much divided, but the evil remains and the cost of the work is greatly influenced by it.

Contrary to the wide spread opinion there is no reason that power farming should be restricted to large farms. The only restriction on the use of tractors in small areas rests in the choice of the machine. Only small, very handy, low-powered machines can be used in this case.

In order that power farming may develop to the fullest extent, farmers and farm labourers should be given a better mechanical training or, at any rate, what training they have should be improved upon.

The drivers should be obtained from the farm-worker class. For this, professional schools are needed. Besides the Noisy-le-Grand school, the author suggests the foundation of "travelling schools of mechanics" for local instruction.

The author next deals with the value and future of power farming as regards its relations with animal power. The mechanical motor is not required to replace the animal motor completely. If motor-culture brings about an increase of yield, it will lead to an increased need of teams for the work that falls exclusively to them. A certain number of draught animals have to be retained for certain work and, between them and tractors, there is an economic equilibrium that is very hard to obtain. It seems, however, that this vicious circle can be avoided up to a certain point by the almost exclusive use of oxen as draught animals, for they can rest without any disadvantage: their maintenance ration has a minimum cost, when it is exceeded they "make meat" and, for industrial farms, they are practical consumers of cumbersome residues (pulses, etc.).

Mechanical traction has certain marked advantages over animal traction. It is above all the theoretically unlimited power that can, so to

space, be condensed in a single machine, whilst with animal traction, the number of animals in a single team cannot be increased.

The power of inanimate motors can be utilised in different ways :

1) by increasing the tractive effort to the detriment of the speed for very heavy work (grubbing, deep ploughing, etc.) ;

2) by maintaining a minimum speed ; the corresponding maximum tractive effort can be utilised by tilling implements working at a slight depth, but over a large surface ;

3) by increasing the speed of traction to the detriment of the pull measured at the draw-bar.

But, on the other hand, the inanimate motor is less supple, it has less elasticity as to power and not such a good grip on the land as animate motors.

The author gives the economic and agricultural characteristics of the different inanimate motors (steam, internal combustion and electric) and the economic and agricultural characteristics of the different ways of utilising motive power in the field — as a tractor or windlass. Each type has its good qualities and defects ; thus it is not surprising that in seeking mixed solutions types of machines have been proposed that are also different from those seen of recent years, and the development of power farming has not attained such a degree that it is as yet possible to decide clearly in favour of any particular proposed principle or system.

The author next deals with the influence of substituting mechanical for animal traction on agricultural technique : on 1) manuring, 2) crop rotations and 3) yields

1) Organic manures will diminish in quantity and the author thinks that the solution of the problem from this point of view lies in the generalisation of the wide-spread methods of 'cultivating without manure', based on the rational utilisation of the inexhaustible nitrogenous resources that Nature provides through the medium of the Leguminosae.

2) One of the consequences of this is the development of forage crops in the rotations (which, besides, require little labour). The forage produced is used primarily for the farm stock, the remainder being sold off the farm or used as green-manure.

Oat growing will lose its importance and that of wheat will increase. Beet-growing may possibly develop, which is desirable for the use of alcohol as a fuel.

3) Most of the results obtained up to the present agree in showing that mechanical cultivation clearly results in increased yields. This is due to the following reasons : — work done with more powerful means can be better done, work can be done that would otherwise be neglected and all the work can be done quickly in the desired time and when the soil conditions are favourable.

Labour is decreasing everywhere in quantity and quality ; recruiting will be more easy with power farming.

The author makes a comparative study of the animate and inanimate motor as regards its cost. The question of fixing the cost price is usually

very complex and very difficult. Besides, as mechanical traction resolves the labour question and leads to economy in labour, while allowing the soil to be worked better and the yield increased, it is of little importance if it costs more than when horses are used.

The value and future of mechanical cultivation in relation to the different crops (cereals, roots, vines) is next considered.

In conclusion, the influence of power farming on the division of labour is dealt with : — intensive cultivation is leading to the division of labour and moto-culture accertuates this fact, and the development of the "undertaking,, can be seen (contractors for threshing, draining, mechanical ploughing, etc).

504 - **Government Tractor Cultivation in England and Wales**(1). — HUTCHINSON Captain G. F. (Mechanical Cultivation Commissioner, Food Production Department), in *The Journal of the Board of Agriculture*, Vol. XXV, No. 9, pp. 1045-1051 + 7 Figs London, December, 1918.

In order to appreciate properly the part played in British agriculture to-day by the tractor, it is essential to consider briefly the history of the tractors employed by the Food Production Department.

The scheme was instituted at a moment when, in consequence of submarine warfare, it became necessary to grow as much corn as possible in the British Isles. To do this some increased and more rapid means of cultivation than those hitherto employed were demanded. Even if sufficient horses had been available, their work was too slow for the emergency ; further, every team of horses required a man, and sufficient men could not be found. Nor was it possible to obtain increased steam tackle. The Government, therefore, resorted to the tractor, which could operate in districts where steam tackle could not, and which required less labour and covered more ground than horses.

In these circumstances, little use could be made of the experience gained with the few privately-owned tractors in the country. It was considered necessary to purchase tractors of all types, wherever they could be found, and set them to work at once. A beginning was made late in the spring of 1917, and the scheme was rapidly developed. In order to utilise the tractors to the fullest extent some system of centralised control had to be improvised, and at the same time local arrangements had to be made for working them and keeping them in repair. These facilities were supplied by the mechanics and repairing shops of the motor trade, which was entrusted with the local management, under the control of the Food Production Department. Tractors were received by each county as they became available ; the Tractor Representative for the county, acting in concert with the Agricultural Executive Committee, arranged their work, they were manned chiefly by soldiers from the Agricultural Companies ; and they were kept running by the proprietors of the provincial motor garages.

At one time, more than 20 types of tractors were employed by the

(1) See R., May, 1918, No. 554. (Ed.)

Government, and it has now been found possible to reduce the types to six. Since 1918, it has also been found possible to decentralise the scheme, and to hand over to each County Committee the control of the tractors allotted to it. In several counties a further advance has been made by loaning the tractors to individual firms to conduct as a private enterprise; tractors have also been sold to individual farmers, and since the beginning of 1918 some 3 000 to 4 000 tractors have been disposed of in this way.

To summarise briefly the results of the scheme, it may be said that it has fulfilled its object. It enabled County Committees in every instance to carry out their programmes for increased wheat production; it assisted them to reap their harvest; and it has introduced a new and highly efficient means of cultivation to the farmers.

A careful distinction must, however, be drawn between the tractor of the Government scheme and the tractor in the hands of the farmer. The former was employed as an emergency measure; in consequence its work was often imperfect, labour was wasted in connection with it, and operating expenses were high. In the hands of the farmer, however, the tractor economises labour and does the work cheaply.

With regard to the high working expenses, the exigencies of the situation required that the Government tractors should be available wherever they were needed. They were, therefore, grouped in units usually of 10 tractors, each unit serving a wide district. Petrol, paraffin and grease had to be delivered daily, thus increasing the cost.

As most of the tractors were made in America where paraffin is little used as a fuel, they had to be fitted with atomisers and superheaters. Time and experience are now meeting this difficulty, but in 1917, the work could not be delayed; petrol could not be spared, but paraffin was available. The tractors were hastily adapted and worked with paraffin, and in some cases this resulted in excessive wear of engine parts. Competent mechanics were not always available and the supply of spare parts for the tractors during the war was a perpetual difficulty.

The Government tractors have ploughed up a great deal of very varied grass land, the object being to produce as much as possible. Farmers did not meet such difficulties as a rule, as their tractors usually had only to plough land that had been previously ploughed. As regards labour, the Government met with great difficulties; in the spring of 1917 about 600 Government tractors were working, while at the same period in 1918 there were over 4 000. Drivers had to be found and trained quickly; in future, these men will be available for the farmers, an advantage owing to the Food Department's initiative. Another advantage which the farmer will have is that he will be able to attach to his tractor the plough or cultivator most suited to his particular requirements, whereas the Government tractor was limited to such implements as were available.

The experience acquired with the Government tractor service shows that to obtain the most economic results from the tractor, it should be in the hands of the farmer, and should not leave his farm, except perhaps

to assist his immediate neighbours, in cases where such an arrangement is possible.

As regards the work done, the acreage results achieved by Government tractors must not be accepted by prospective purchasers as a final test of their capabilities. The weekly reports published by the Food Department show that few counties were able to maintain an average of 10 acres ploughing per week per tractor, or a fuel consumption below 5 gal. per acre. In nearly every county, however, a FORDSON tractor, with a self-lift plough, has ploughed over 5 acres in the day under favourable conditions, in the hands of one reasonably competent man or woman. The same tractors have frequently cut upwards of 15 acres in the day with a binder which would not be exceeded by two teams of three horses working in shifts.

It was proved in every county that the quality of the work done by tractors is perfectly satisfactory. The same applies to the quickness of their work.

The Food Production Department have employed more than 20 types of tractors, six of which have now been retained. Amongst these the author mentions: — 1) the "Titan" (1) tractor, which has done excellent work under the most varied conditions; 2) the "Overtime" (2) tractor, a general utility machine which has given satisfaction; 3) the CLAYTON SHUTTLEWORTH tractor which is especially suitable on heavy clay land, the pressure on the land being much reduced by a caterpillar track; this is the only tractor of this type now operated by the Government; 4) the SAUNDERSON tractor (3), of British make, which has the advantage of a winding drum; it has been found more satisfactory than other tractors for roadwork; 5) the 25 H.P. «Mogul» (4), a heavy tractor, employed mainly for threshing; in some counties it has done a lot of ploughing when the land was in a suitable condition; it is too heavy for use on wet land; 6) the FORDSON (5) tractor probably the cheapest tractor on the market; it is not a general-utility tractor, as it may prove to be too light to be used effectively as a stationary engine, but for the purpose of cultivating it is an acknowledged success; it is the only Government tractor equipped with a self-lift plough, and can, therefore, be worked by one man, it has given good results in heavy soils in suitable condition for ploughing, such as those in Essex and other counties.

No less than 2 500 FORDSON tractors have been bought by private owners. For some time its reputation suffered because the No. 7 OLIVER plough attached to it turned a 14 in. furrow, which in many cases proved unsatisfactory. This plough has now been converted to turn a 10-in furrow, with the best results. Other improvements now being carried on by the Department are the provision of a «governor» for the engine, a brake for roadwork, and a "release" attached to the draw-bar.

(1) See R., 1917, No. 274, and No. 1051. (Ed.)

(2) See R., 1916, No. 896; R., 1917, No. 753; R., 1918, No. 81 — (3) See R., 1918 No. 678. — (4) See R., 1916, No. 670; R., 1917 No. 753 — (5) See R., 1917, Nos. 755 and 1051. (Ed.)

The proper course for a prospective purchaser of a tractor is to examine the work of his neighbour's tractor, or of the different types of Government tractor in his county before making a selection. He can also obtain full information from the officials employed by the Executive Committee of his county, and by this means he can see and judge for himself which type best suits his particular requirements. It only rests with the farmer to take advantage of what is probably the widest form of practical demonstration ever carried out by any Agricultural Department.

The author of these notes has seen something of the work of the Government tractors in practically every county in England and Wales.

505 - **De Dion Bouton Motor Windlass.** — RINGELMANN, in the *Bulletin de la Société d'encouragement pour l'industrie nationale*, Year CXVII, 2nd Half-Year, Vol. CXXX No. 6, pp. 476-479 + 4 Figs. Paris, 1918

The author describes the DE DION-BOUTON motor windlass which took part in the demonstrations held at La Verrière, Mesnil, and St. Denis (1). The following information, extracted from the *Illustrated Official Journal of Patents* of July 17, 1918, relates to the patent applied for in England under the No. 115 856 of May 15, 1918.

Figures 1 and 2 show the chief parts of the windlass.

In the plan (Fig. 1) can be seen the engine *M* with 4 vertical cylinders and its fly-wheel *r*, the epicyclic clutch *8* with its drum *13* reducing the speed to the propeller shaft *16* connected by a cardan shaft *19* to the primary shaft *20* of the gear-box *21*. The plan also shows the driver's

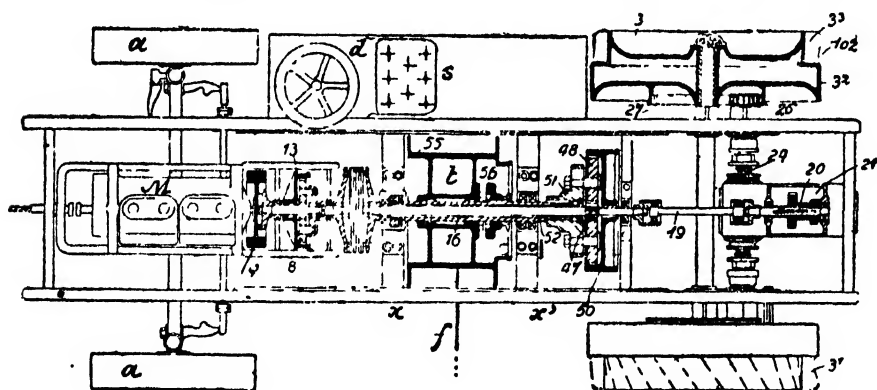


Fig. 1 — Plan of the de DION-BOUTON motor-windlass

seat *s* at the side and the steering wheel *d*. The placing of the lateral seat on the opposite side to the hauling cable *f* is similar to that already noted in certain American machines; when working, one machine has the seat on its right side (Fig. 1) while the other machine has it on the left. When the windlass is not hauling the plough (as in ploughing with

(1) See *R.*, February 1919, No. 238. (*Ed.*)

steam tackle (*Culture mécanique*, Vol. I.), and the machine is to move forward, the sliding gears 35 and 38 slip on the primary shaft 20 and

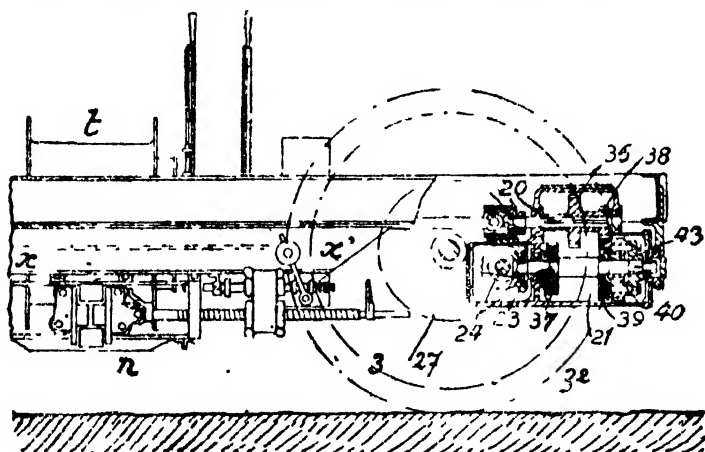


Fig. 2 — Elevation of gear box of the de DION BOUTON motor windlass

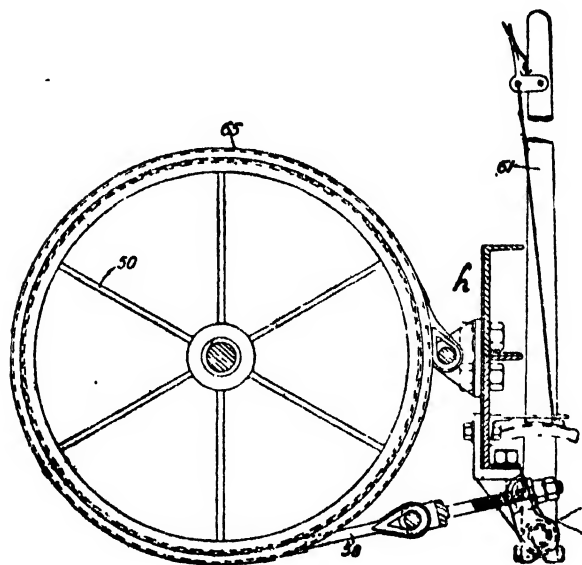


Fig. 3 — Brake drum of the de DION BOUTON motor windlass

engage with gearing 37 or 39, giving the top and bottom speeds respectively ; the reverse is obtained by engaging the wheels 40 and 43 ; the shaft carries a bevel-gear 23 driving a counter-shaft 24 carrying pinions 26 meshing with the internally toothed rings 27 on the driving wheel 3.

The driving-wheels **3** have a double rim, an inner smooth rim **3^a** and an outer rim **3^b** of smaller diameter provided with gripping blades **3^c**. The annulus **102** beds into the ground when the tractor is hauling a plough and prevents lateral movement due to the haulage cable being parallel to the back axle. The front wheels are provided with bosses to which tools are secured, which are adapted to penetrate into the ground for a similar purpose.

The winding drum **55** is concentrically arranged on the propeller shaft and is driven from it through a pinion **47** on the shaft, epicyclic gearing **48**, sleeve **51**, tubular shaft **52**, and dog-clutch **56**. The brake drum **50** (Fig. 3) is provided with a cable **65**, one end of which is fixed to the chassis **h** and the other, **58**, to a ratchet operating-lever **61**, which controls the braking of the drum.

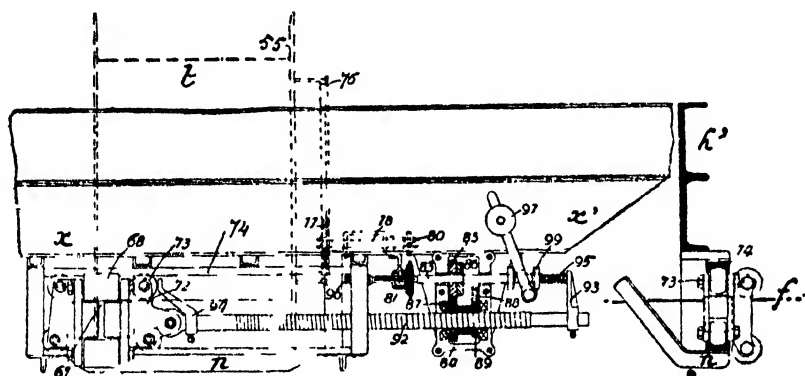


Fig 4 — Rope-laying device of the de DION-BOUTON motor winlass

The cable, coming from **f** (Fig 1), winds evenly on the drum **55**, the winds being in contact and never overlapping, which might break the cable; to do this, a rope-laying device is provided, mounted on the chassis at **xx'**, on the opposite side to the seat and on the side of the field being ploughed, to the left of the tractor shown in Fig. 1 and to the right of that standing on the opposite headland.

The cable passes between 4 guide rollers **67** and **68** (Fig. 4) mounted on a carriage **72** having rollers **73** running on rails **74**, according to the movement of the horizontal screwed spindle **92**, which is moved backwards or forwards by the pinion **87** forming the nut for the screwed shaft through the pinions **84** and **89**, and the idle wheel **88** which moves the carriage in the reverse direction. The wheels **87** and **88** can be driven consecutively by one of the wheels **85** or **86** according to their position; these wheels **85-86** are keyed on the shaft **83**, which can be reversed by stops **93**, **94** on the ends of the screwed shaft, the counterbalance weight **97** operating between stops **99** on shaft **83** holding it in position. This shaft is driven through chain wheels **80** and **81**, the first of which is keyed on shaft **78** driven by the pinion

77 and the wheel 76 on the drum *t* of the windlass 55. In Fig. 4, part of the chassis of the motor windlass can be seen at *h'*.

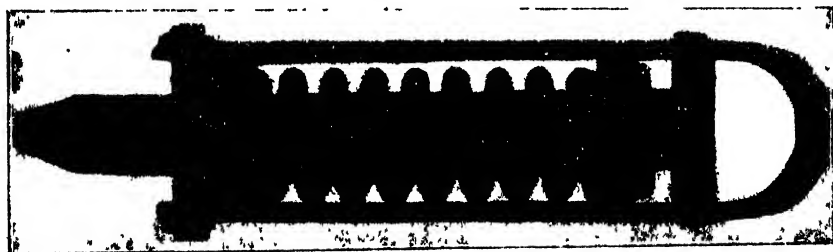
506 - Tractor Shock-Absorber. — DESSAISALX R., in the *Journal d'Agriculture pratique*, New Series, Vol. XXXI, No. 15, p. 292. Paris, July 25, 1918.
Tractor shock-absorber, made by the firm of BRILLÉ.

The results of M. RINGELMANN'S researches on shock-absorbers ("amortisseurs") can be summarised as follows: — with a well designed shock-absorber an economy of 33 to 54 % can be obtained on the starting effort of a motor and from 10 to 30 % on its average tractive effort.

If with the use of the shock-absorber animate motors are tired less, it acts similarly on inanimate motors by economising a part of the fuel used the quantity and, consequently, money value of which can be calculated. Thus taking a tractor that consumes 3.75 gal. to plough an acre, 1.25 gal. is required to propel the tractor and 2.50 to work the plough. The economy in fuel obtained with a shock-absorber can only affect 2.50 gal. per acre. If the saving is 20 %, it represents 0.5 gal. per acre; if it is 30 %, it represents 0.75 gal. per acre. Lately in France, petrol cost 4s. 4d a gallon in the field, so that according to the above figures, the economy procured by using the shock-absorber amounts to from 2s. 2d. to 3s. 3d. per acre.

It is, therefore, advisable to place a shock-absorber between the tractor and the plough, all the more because by reducing the shocks and vibrations of the tractor, the machine deteriorates less.

The appended figure shows a shock-absorber made by the firm of BRILLÉ, 28, Boulevard de Villiers, Levallois-Perret (Seine). The buffer spring, which blocks under a pull of 2 200 to 2 640 lb. is held between two plates on which work curved irons, the buckle of which serves as a yoke-ring; the cross pieces prevent the ring from closing and allow the necessary play for the irons to slide on the plates.

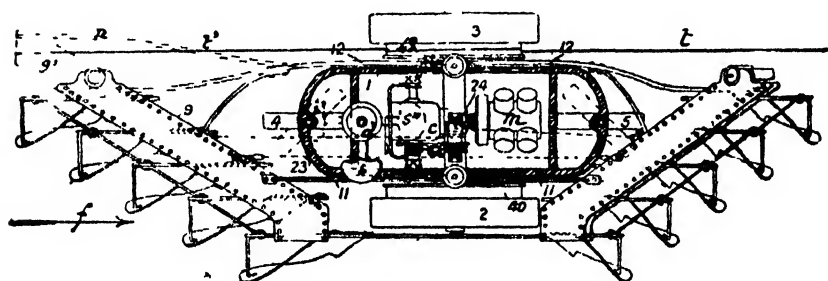
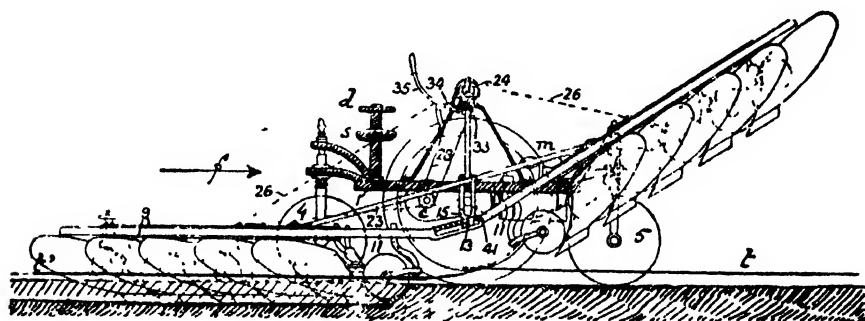


Tractor shock-absorber, made by the firm of BRILLÉ.

507 - Tony Ballu Motor Balance Plough. — RINGELMANN M., in the *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year CXVII, Vol CXXX, No. 6, pp. 481-482. Paris, November-December, 1918.

The principle of M. TONY BALLU'S motor balance-plough is shown in the appended two figures.

The central chassis 1 carries the engine *m* and its accessories, the gear-box *e*, etc., the two driving wheels 2 and 3 and the steering wheels 4 and 5 controlled by the driver from his seat *s* by means of the wheel *d*; the seat can be placed at *s'* or *s''*.



TONY BALLU motor-balance plough

Upper figure — Elevation.

Lower figure — Plan.

According to the work to be done, the chassis runs with wheels 2 and 3, the tyres of which are fitted with tools to give more grip on the land.

If ploughing is to be done, one of the wheels (No. 2, on the side to be ploughed) is fitted with strikes to give more grip. For other work or with other tools, the haulage cable winds on the drum 40 fastened on the wheel 2.

The machine can thus work as a direct tractor with the driving wheels 2 and 3 or as a haulage tractor, with the difference that the haulage cable winds on the drum of one of the wheels, the other acting with its gripping tools as a tractor driving wheel. For certain kinds of work two haulage cables can be used, one on each drum 40 and 41 of the driving wheels 2 and 3.

In the figures the application has been made to an „anti-balance“

plough, the details of which are shown at Nos. 9, 11, 12, 13, 15 41, with a possible extension *n* of the frame 9 to 9'. The lever 35-33-34 gears up the windlass 24 driven by the chain 28 and, through the chains 26, tips up the ploughs at the furrow end. The machine can be used for ploughing without ridges.

508 - Experiments on the Mechanical Cultivation of Rice in Cochin-China. — LABASTE, LEGRAS y MORANGE, in the *Bulletin agricole d'l'Institut scientifique de Saïgon*, Year I., No. 1, pp. 4-12. Saïgon, January, 1919.

Cochin-China takes the second place, immediately after Burma, among the largest exporters of rice in the world. The quantity exported by it varies each year from 1 to 1 ½ million metric tons of decorticated rice of a value of about 200 million francs. The total production of the colony varies round 2 ½ million metric tons. The preparation of the soil and harvesting, being carried out by primitive methods, take a long time, and the production could be increased considerably if machinery replaced hand labour, for uncultivated land suitable for rice fields covers an area of several million hectares in Cochin-China and Cambodia alone.

In western Cochin-China there are vast estates occupied by a single tenant and growing rice each year. For a long time the Administration and the Chamber of Agriculture have been occupied with the application of modern methods of mechanical cultivation to the preparation of the soil and to the harvest. Each year, at the request of the Colonial Council an important credit was inserted in the budget of Cochin-China for these experiments, but it was never possible to utilise it. In 1917, when the Mission for the Inspection of Agriculture and Forests was organised, the Governor General, M. ALBERT SARRAUT, directed that the experiments were to be commenced. Thanks to the help of the Supplies and Transport Service and to the kindness of the American Consulate, the necessary machinery was imported from the United States and was at once put in working order by the staff of the School for Naval Mechanics.

The first experiments were begun in February in rice fields near Saïgon. They were next carried out in western red earth lands devoted specially to Hevea. After April 18, experiments on a larger scale were carried out in the province of Soc Trang on the farm of M. LABASTE, vice-president of the Saïgon Chamber of Agriculture.

The authors publish the chief documents relating to these trials. The last was written by the late P. MORANGE a few days before his death.

PARTICULARS OF THE MACHINES EXPERIMENTED WITH.

1) *Holt tractor* — 45 HP. *Caterpillar Type*; —

Total length of machine	12 ft. 5 in.
Total breadth of machine	8 ft. 5 in.
Width of chain tracks	27.3 in.
Length of track in contact with the soil	6 ft. 6 in.
Carrying surface of each track.	34.5 sq. ft.
Total carrying surface	34.5 sq. ft.

Weight of tractor in running order	169 cwt
Pressure on soil: weight per sq. dm. of carrying surface	30.89 kg.
Four cylinder engine	600 revolutions per minute.
Total power of engine	40-45 H.P.
Effective tractive power,	20-25 H.P.
Two speeds, working	1.4 and 2.1 miles per hour
Road speed	2.5 miles per hour
Hourly petrol consumption	4.4 to 5.5 gal. during work according to its nature.
Hourly consumption on the road.	2.61 gal. . . .
Ignition by a high-tension magnet.	
Petrol tank holding	45 gal.

2) *Four-furrow ploughs with wooden frames:—*

Width of work per plough	59 in.
Distance between shares	14.6 in
Total width worked with 2 ploughs.	10 ft. 2 in.
Weight of each plough	1540 lb.
Area ploughed per 10-hour day from	12.3 to 19.8 acres according to the working depth

3) *Norwegian harrow with metal frame:—*

Total weight	990 lb.
Two rows of "stars" arranged in spirals round axles	58.5 in. long and 15.6 in. apart
Each axle includes 21 "stars" with 5 branches each	6 in. long
The "stars" are	4 in. apart
The implement has a fore-carriage and is provided with 3 wheels for transport on the road.	

The conclusions arrived at from the trials of the 45 H.P. caterpillar Holt tractor and the gang ploughs (two ploughs with 4 shares each) are given below.

1) *Tractor.* The tractor is easy to drive and very supple in manœuvring, but it cannot work in the rice fields which are quite sodden at the time when cultivation is usually carried out by native methods — by hand or with buffaloes; the tractor sinks in too much and cannot go forward in such soft soil.

The following changes are suggested after experiments lasting 3 months:

a) Widening the chain tracks which, instead of being 27.3 in. wide should be 33 to 35 in. wide if possible.

b) The chain tracks should be fitted with strakes projecting at right-angles to the track so that it will grip the soil better and enable the tractor to advance without slipping, i. e. so that the track will not turn round on itself; it is suggested that half the chains of each track (i. e. 13 out of 26) should be fitted with strakes projecting about 3 in.

c) The tractor should be supplied with a carburettor to enable it to burn paraffin rather than costly petrol.

d) The machine should be provided with an electric-lighting apparatus for night work and a special pulley for driving farm machinery.

c) The point at which the ploughs are attached to the tractor is too low; owing to this, the two first shares tend to penetrate too deeply in the soil.

2) *Ploughs*. — The two 4 furrow ploughs sent by Messrs. HOLT are unsuitable for work in rice fields in Cochín-China, and they have had, therefore to be modified completely.

a) The shares, in their longitudinal alignment, are too near together, so that grass sticks to them and they frequently get stopped up with weeds and soil, thus causing frequent stoppages.

b) The shares are much too large and heavy; they might well be replaced by small ploughs of the Oliver type, assembled in groups of 8 to 10 on an extra-light frame, which is preferably wholly metallic; the straight cast-iron braces could be replaced by a strong hoop-shaped angle-iron, affording little hold to the uprooted weeds.

c) The system of lifting with levers and toothed sectors must be replaced by a system with a wheel and vertical endless screw.

d) The shares should be sufficiently far apart (at least 35 in. in the horizontal alignment) to avoid choking up.

e) The trailing wheels should be replaced by very large and very light drums; the fork of the idle wheel which favours choking up, should be suppressed; instead of drums, skids with a large surface could be tried; the drum or skid in front, regulating the depth of ploughing, should be enlarged by at least 23 in. from the first share.

f) Instead of ploughs the use of strongly built, but light disc scarifiers might be studied, the machine not going below 8 in.

From these trials it appears that it is quite possible to plough rice fields by directly hauling the implements. From the preliminary groupings, even from the negative results obtained at Saigon, very interesting and encouraging conclusions can be drawn.

If the Agricultural Services make the teachings of practice clear, it will doubtless be possible to do much better later on.

It would be very interesting to carry out multiple ploughing tests in Hevea soils, with the modified ploughs; new observations could be made that might lead to fixing the practical kind of machine for proper mechanical cultivation in Cochín-Chinese⁷ soils, whether⁸ inundated or not.

509 - **Review of Patents.** — CANADA U. S. A., UNITED KINGDOM, SWITZERLAND. — for sources, see R JANUARY, 1910, No 101 — FRANCE, see R FEBRUARY 1910, No 217. — INDIA — *Indian Textile Journal*.

TILLAGE MACHINES AND IMPLEMENTS. - *Canada*: 187320, Plough lever; 187484 — 188510 Ploughs.

France: 480421 Improvements to ploughing implements for motor-culture; 480578 Improvements to driving wheels for power farming machines and other similar applications; 480582 Plough.

India: 4008. Tractor plough.

United Kingdom: 120450 Steam tackle for ploughing, etc; 120586

121341. — 121640 Ploughs; 120587 Machine for extracting the soil, roasting, then replacing it; 120687 Motor plough; 121607 Device for lifting a plough share above obstacles met with in the soil; 121930 Cable system of mechanical ploughing.

United States: 1283650 — 1285008 — 1285171 Ploughs; 1283679 Plough attachment; 1283974 — 1284208 — 1284617 — 1285551 — 1286557 1286710 — 1288241 — 1289176 Cultivators; 1283811. Couch grass exterminator; 1284089 Device for regulating the height of the chassis of a motor plough in relation to the guiding wheel; 1284871 Disc coulter; 1284901 Harrow attachment; 1286127 Drill plough; 1286268 Roller attachment for seeder; 1286354 Disc plough attachment; 1286545 Garden plough; 1286585 Steering lever for sulky cultivator; 1287749 Pulveriser; 1288321 Weeder; 1288571 Garden cultivator; 1288608 Toothed roller for tillage machine; 1288773 Traction plough; 1289023 Weeder harrow with toothed roller; 1289094 Tillage machine; 1289333 Device for lifting a reversible plough; 1289700 motor-plough; 1289462 Gang plough.

Switzerland: 45872 Modification of land-rollers; 59587 Cylinder for land and meadow rollers; 80647 — 80648 Motor-ploughs.

MANURES AND MANURE DISTRIBUTORS. — *Canada*: 188430 Manure spreader.

France: 489566 Fertilising and insecticidal nitrifying product (1).

India: 4101 — 4101 — 4110 Improvements in the manufacture of ammonium nitrate; 4102 Improvements in the manufacture of chemical fertilisers; 4103 Improvements in the production of nitrates; 4111 Process for the preparation of nitrates by means of bacteria; 4113 Process for oxidising ammonia, ammoniacal compounds or organic nitrogen compounds.

United Kingdom: 121082 Process for manufacturing ammonium sulphate.

United States: 1284667 Manure cart; 1285183 — 1291436 Fertiliser distributors; 1286430 — 1289513 Manure spreaders.

Switzerland: 80917 Manure spreader.

DRILLS AND SEEDING MACHINES. *Canada*: 187287 Drill.

United States: 1283892 1285327 Potato planters; 1281290 — 1289120 — 1291164 Planters; 1281589 Drill; 1286044 — 1290991; Maize planters; 1286268 Roller attachment for drill; 1286616 Distributor for drill; 1288194 Planter; 1290978 Planter attachment for ploughs and cultivators; 1291152 Seed hopper for drills.

Switzerland: 75741 Planter; 80918 Drill.

VARIOUS CULTURAL OPERATIONS. — *United States*: 1283664 Chopper for cotton and sugar beet.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Canada*: 188279 Insecticide (60 % Paris Green + 20 % anhydrous sulphate of copper + 11 % slaked lime).

(1) See No. 121 of this Review

France: 489 566 Fertilising and insecticidal-nitrifying product (mixture of calcium sulphide and heavy tar oils purified by the elimination of the bases and acids, with the addition or not of gypsum and phosphate — TRUFAUT patent).

United Kingdom: 121221 Rabbit and hare trap; 121690 Insecticide (2/4 aloes powder + 1/4 alum + 1/4 rock salt, all by weight).

United States: 1285826 Machine for destroying the cotton boll-worm. REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada*: 187291 — 187364 — 187495 — 187510 — 187581 — 187610 Shocking machines; 188777 Harvester.

Switzerland: 80777 Mechanical mower; 80919 Sheaf-tying machine.

United Kingdom: 121681 Flax etc. harvester; 121682 Lawn mower.

United States: 1283721 Two-row maize harvester; 1283816 — 1289519 Hay rakes; 1288249 Hay rake with central delivery; 1284737 — 1288499 Bean harvesters; 1285005 — 1285099 — 1288301 Maize harvesters; 1286220 Header for cereals; 1288479 Elevator for a harvester; 1289423 Hay sweep; 1290017 Tractor-driven harvester; 1290923 Binder for maize heads; 1291295 — 1291393 Mowers; 1291392 Hay-tedder.

MACHINES FOR LIFTING ROOT CROPS. — *United States*: 1283810 — 1284449 — 1286092 — 1288300 — 1291567 Beet harvesters; 1285276 — 1288541 Peanut harvesters; 1285529 Combined beet harvester and topper; 1285611 Peanut digging plough; 1285632 Potato digger; 1288224 Beet topper.

THRESHING AND WINNOWER MACHINES. — *Switzerland*: 80921 Maize husker.

United States: 1283541 Maize huskers; 1285783 Conveyor and dresser for grain; 1288341 Thresher attachment; 1291571 Threshing machine.

MACHINES ETC. FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Switzerland*: 80780 Process for preserving agricultural products by means of carbon dioxide; 80920 Process for treating sugar beets in order to increase their yield of crystallisable sugar and also to preserve them.

United States: 1283498 Conveyor and elevator for grain, forage etc.; 1285624 Hay-cocking machine; 1285783 Elevator and dresser for grain; 1285895 — 1288656 — 1288838 Hay presses; 1289004 Chopper and elevator for forage to be ensilaged; 1291462 Machine for unloading hay.

United Kingdom: 120695 Fruit, potato etc., sorter; 121343 Peanut sheller; 121394 Apparatus for drying vegetable products; 121650 Apparatus for sterilising grain, seed, nuts, etc., with formalin; 121901 Hay loader.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *France*: 489578 Improvements to driving wheels for power farming machinery and similar applications.

Switzerland: 80649 Agricultural tractor.

United Kingdom: 120459 Steam tackle for ploughing, etc.

United States: 1284577 — 1285307 — 1285472 — 1285995 — 1286146 1286399 — 1288022 — 1288952 Tractors; 1286585 Steering lever for sulky cultivator; 1287803 Garden tractor.

FEEDING OF LIVESTOCK. — *United Kingdom*: 121295 Cattle food made from marine plants; 121586 Yellow-mustard seed cake.

United States: 1285348 Automatic food distributor for pigs.

POULTRY FARMING. — *Canada*: 187347 Electric incubator.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *India*: 4071 Improvements in the manufacture of soya milk and the complete utilisation of the by products; 4130 Improvements in the manufacture of linseed and other oils.

Switzerland: 80781 Modification in machine for extracting the kernels of nuts; 80920 Process for treating sugar beet in order to increase their yield in crystallisable sugar, etc.

United Kingdom: 120991 Oil-press; 121405 Machine for drying chopped potatoes.

DAIRYING. — *Canada*: 188769 Milking machine.

United Kingdom: 121049 — 121064 — 121189 Churns; 121133 Artificial milk; 121384 Milk can.

United States: 1285079 Teat cup for milking machines.

VARIOUS. — *Canada*: 188329 — 188785 Bird traps; 188901 Traps for small animals.

RURAL ECONOMICS.

510 — **Validity of the Survey Method of Research.** — ¹SPILLMAN, W. J (Chief Office of Farm Management) in *U. S. Department of Agriculture Bulletin* No 529, pp 15, Washington, D. C., April 5, 1917.

Knowledge of the details of farm practice and of the results arising from this practice may be obtained in two ways. First, careful records may be kept of the details of the farm work and the business transactions of the farmer. Second, such details may be obtained by interviewing farmers who give them as accurately as may be from memory, or from such desultory records as may have been made of the farm operations. The first of these methods involves years of labour and enormous expense; the second gives an enormous amount of data in a short time and at a nominal expense. The question is as to the relative accuracy of these two methods.

The author cites numerous comparisons of farmers' estimates with actual records, and states that "our studies lead to the conclusion that errors in the farmer's knowledge of the details of his business and of the work he does are in every way comparable to the departures from the true mean in field plot experimental work, and that they distribute themselves about the true values in approximately the same manner. The fact that the survey method of investigation gives data sufficient to permit the law of averages to eliminate plus errors by the occurrence of similar minus errors, while plot experiments ordinarily do not do this, appears to justify the statement that the survey method is a more reliable means of arriving at those facts

to which it is applicable than the field plot experimental method. It appears, in fact, to occupy a place intermediate between plot experiments on the one hand, where variations in other factors than that under observation occur and are not adequately eliminated, and laboratory studies on the other hand, in which variations in other factors are largely prevented. These variations due to factors other than that studied do occur in using the survey method, but the amount of data obtained by this method is sufficient to permit the elimination of such variations by the operation of the law of averages.

511 - Value of a Small Plot of Ground to the Labouring Man: A Study of the Food Raised by Operatives in Southern Cotton Mill Towns - FUNK, W. C., in *U. S. Department of Agriculture Bulletin No. 602*, pp. 10, Washington, D. C., March 5, 1918

A large acreage of land can be used for agricultural purposes which is not generally classed as farm land. This area includes the backyards and small holdings of less than 3 acres within and close by cities and villages. Much of this land is already being used for raising food for home consumption, but more is lying idle. The last census reported over one million cows and over one million hogs not on farms; this indicates that much milk and butter and much pork are produced by village and city families for home consumption.

Southern textile companies furnish houses for the cotton-mill employees. The mill buildings, surrounded by the operatives' houses and the few necessary stores and shop buildings constitute the mill village. This bulletin is a study of food raised by operators in such villages, and is based on records of 548 gardens, 165 poultry flocks, 75 cows and 62 pigs.

It was found that the average size of the gardens was 723 sq. yards, the average annual value of the vegetables raised \$ 29.87, and the average cash expenditure \$ 3.54. The average size of the flocks was 13.2 hens, and the number of eggs used and sold was 86 dozen valued at \$ 19.35. In addition the number of fowls sold and used was 36 valued at \$ 11.07, making a total income of \$ 30.42 per flock. The average cash expenditure was \$ 16.22. In the case of the pigs, the average purchase price was \$ 6.34 and the average live weight at killing was 270 lb. valued at \$ 24.30. The cost of feed was \$ 12.12, leaving a net return of \$ 5.84 after deducting the purchase price. The value of the produce from the dairy cow was estimated at \$ 119.00 and the average cost of feed was \$ 80.49 a year.

512 - A Study of the Share Rented Dairy Farms in Green County, Wis., and Kane County, Ill. U. S. A. - - BORGER F. A., in *U. S. Department of Agriculture, Bulletin, No. 603*, pp. 14, Washington D. C., April 10, 1918

The great increase in American dairy farming and the spread of farm tenancy in dairy regions together tend to emphasise the need for exact knowledge concerning the relation between landlord and tenant on share-rented dairy farms. The work described in this bulletin was undertaken in two representative dairy regions with a view to ascertaining the nature of this relationship and determining the profits made under it by landlord and tenant. The material for this study was obtained from 84 farm-management survey records made in Green County, Wis., in cooperation with the

Wisconsin Experiment Station, and from 59 records made in Kane County, Ill. all for the crop year 1915, together with data from 147 survey records taken in the Illinois region by the Illinois Station in 1912.

With regard to rental terms, the landlord in the Illinois group generally owned the cows and paid all the farm road tax, while in the Wisconsin group he owned but half the cows and paid only part of the road tax. In the Wisconsin group 76 % of the leases ran for one year, none being for more than three years. In the Illinois group 63 % of the leases were for one year, none being for more than five years.

The average farm in the Wisconsin group had 140 acres tillable and 84 acres in pasture and supported 25 cows. The Illinois farms averaged 139 acres tillable and 58 acres in pasture and supported an average of 43 cows. Corn, oats, timothy, and clover are the important crop of each region. Corn in the Wisconsin group occupies 37.4 % of the crop area, and in the Illinois group 51.4 %. The Wisconsin cows produced an average of 70\$ worth of dairy products, and the Illinois cows 89.4 worth per head annually. In the Wisconsin group, 74 % of the cows are grade Holsteins, and 51 % of the farms have pure-bred Holstein bulls. In the Illinois group, 56 % of the cows are grade Holstein, and 53 % of the farms have pure-bred Holstein bulls. Seventy-five % of the farm income on the farms of the Wisconsin group, and 85 % on those of the Illinois group, are from dairy cattle and their products. In the Wisconsin group, 21.5 % of the cows were home-raised heifers that came fresh during the year, and 18.9 % of the herds were discarded or sold as dairy cows. The farmers here raise their cows instead of buying them. In the Illinois group, 8 % of the cows were home-raised heifers with first calves, while 28.1 % of the herds were discarded, indicating that this is a dairy-cow purchasing region.

In the Wisconsin group, both landlord and tenant make least on farms selling butter fat, more on farms marketing milk through the cheese factory, and most on farms selling milk to condenseries. In the Illinois group, none of the milk was made into cheese and the profits were about the same, both to landlord and tenant, whether the milk was sold to the condensery or for market. The introduction of pure-bred cows in the dairy herd in the Wisconsin group is very profitable both to landlord and tenant, but it seems to be profitable only to the tenant in the Illinois group. In both the Wisconsin and Illinois group the tenant remained on the farm longer under the yearly lease than he did where the lease was for a longer period.

513 - **The Relation of Size of Dairy to Economy of Milk Production.** — HOPKINS, J. A., Fr. in *Delaware College Agricultural Experiment Station Bulletin No. 115*, pp. 50 + 2 Fig. Newark, Delaware, January 1918.

In this study the object was to determine the correlation between the size of dairies operating under given conditions and their profitableness as indicated by profit per cow per year, cost per quart of milk, and profit per quart. The investigation was conducted during 1916 and involved 87

dairies in Northern Delaware and South Eastern Pennsylvania. As a method of comparison these dairies were divided according to size into 9 classes which varied from dairies of less than 10 cows in class 1 to those of from 75 to 100 cows in class 9. Data for each of the classes are tabulated and discussed in detail.

The following table gives some of the results obtained : —

Effect of Size of Dairies on Cost of Milk Production.

Number of cows in dairies	Number of herds	Average annual production per cow	Cost of feed and pasturage per cow	Cost of labor per cow	Total expense per cow	Cost per quart of milk		Price received per quart of milk
						Lowest	Average	
		Quarts	\$	\$	\$	cents	cents	cents
Under 10	10	2 ' 44	92 23	27 46	163 91	5 8	7 70	5 2
10-14	11	1 873	94 48	1 2	15 36	5 6	8 40	4 4
15-19	10	2 32	81 39	25 82	151 79	3 9	6 35	4 6
20-24	11	2 375	86 88	23 54	159 40	4 6	6 50	5 3
25-29	9	2 935	90 20	27 23	167 52	4 0	5 50	5 7
30-39	10	2 939	91 78	22 71	115 18	3 4	5 20	4 9
40-49	8	2 891	80 35	23 03	150 43	3 6	4 70	4 6
50-74	8	3 0 8	90 81	24 28	164 80	3 8	5 20	5 2
75-100	9	3 475	97 57	46 96	218 41	3 7	5 90	7 2

The superior productiveness of larger dairies was found to be caused, in part at least, by the better type of cows which they kept. The cost per cow for hauling milk increased slightly as the addition of another horse became necessary; then decreased again as the size of the dairy increased. Cost of bull service per cow decreased as size of dairy increased up to 40 cows, then increased slightly as a second bull was added, and increased again as a third bull was added in dairies of over 80 cows. Cost of supervision increased slightly with the size of dairy. However, this added expense was more than offset by greater intelligence of management. The larger dairies produced a higher grade of product than the smaller ones and disposed of it at a higher and better price.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDENT ON PLANT PRODUCTS

514 - The Role and Proportion of Pears in Cider Making. - TRUILLE A, in *Le Cidre et le Poiré*, Ycat XXIX, p. 169 January, 1928. Summary in the *Annales de la Science agronomique*, Ycat XXXVI, No 1-3, pp. 81-82. Paris, January-March, 1929.

The admixture of pears with apples is now authorised in France. In cider making in other countries pears are used in proportions varying between 10 to 60 %; the proportion generally recommended being from 25 to 30 %.

According to the author the proportion to be used depends: - 1) on the fact that the flavour and quality of cider should not be neutralised

and its chemical composition should not be lowered below that prescribed in the French regulation of 1908 ; 2) on the nature and the rôle of pears, according to whether they are intended to improve the juice and the cider or to preserve the cider from certain diseases.

The proportion can be ascertained by chemical and microscopical examination or, more simply, by a series of practical tests. In any case it seems that it should not exceed 20 %. In making choice brands of cider only picked varieties of apple, either alone or mixed, should be used, while no pears whatever should be mixed with them.

515 - Cane-sugar Industry in Western Venezuela. — SAUER E. in *Commerce Reports* No. 202, p. 707. Washington, D. C., 1917.

The cane-sugar industry in a certain form has existed for a long time around Lake Maracaibo. There were established a large number of small mills making a brown sugar called « papelón » or « panela », put up in blocks and polarizing from 70° to 75°. This sugar was made only for the local market and Curaçao, practically none being exported to other countries until 1916, when, owing to the high price and scarcity of sugar, \$ 15 435 worth of « papelón » was shipped to England and \$ 732 worth to the United States. The total amount of « papelón » exported from Maracaibo in 1916 was 3 325 783 pounds, valued at \$ 71 453, against 2 912 780 pounds, valued at \$ 49 735 in 1915. There are some 25 « papelón » mills in the vicinity of Bobures and Encontrados del Zulia, each with its cane plantation. One of these mills makes white sugar, but only for the local market.

The manufacture of white sugar for export to the United States has its origin in the lowering of the American duties under the tariff act of 1913, but factories were not completed for operation until the autumn of 1915, when the grinding season began. During the last months of 1915 \$ 57 804 worth of sugar was invoiced for export to the United States. Four factories making centrifugal sugar were erected on the south and east sides of Lake Maracaibo, at Bobures and La Ceiba.

It is reported that a much larger quantity of cane per acre is produced than in Cuba, or other cane-sugar countries but that the sugar-content of the cane is much less, the extraction being 6 to 7 per cent of the weight of the cane in Venezuela, against 10 to 14 per cent in Cuba, Hawaii and elsewhere. Another drawback to the sugar industry on Lake Maracaibo is the climate, which, it is said, tends to discourage even native labour.

516 - *Monilia sitophila*, a Hyphomycete observed on Army Bread and new to the Italian Mycological Flora. - MARTIROLO O., in the *Atti della Reale Accademia delle Scienze di Torino*, Vol. LII (1917-1918), 9 pp. Turin, 1918.

In the autumn of 1917 and the spring of 1918 the presence of *Monilia sitophila* (Mont.) Sacc. was recorded on army bread at Turin (Piedmont). The mycelium and fructification of the fungus developed on the bread in such a way that in a few days, it was covered with thick mould of a characteristic orange-red colour.

The author rapidly gives the history of this species, which is new

for the Italian flora, and describes it. *M. sitophila* has previously been observed only twice in France where, as in Italy, it has been apparently introduced with foreign wheat destined for military use.

517 — Oil Extracted from the Fruit of the Elm. — KREIS H., in the *Schweiz. Apotheker-Zeitung*, 1918, p. 483. Summary in *Oliven en Vellen*, Year III, No. 31, p. 239. Amsterdam, January, 1919.

The samara of the elm weighs on an average 7 mgm with the wing and 5.5 mgm. without it. Its starch content is very small. Without the wing it has the following chemical composition: — Water, 9.3 %; Ash, 5.09; Crude fibre, 5.95; Nitrogenous matter, 34.35; Fats, 28.22; Nitrogen-free extract, 17.09. It is therefore, rich in fat.

By extracting with ether, a greenish oil was obtained that has no special odour or taste and which, at 0°C., « takes » only partially, with the separation of fine needle-shaped crystals. After adding a mixture of concentrated nitric and sulphuric acids its green colour becomes more prominent, then changes to dark brown. The oil has the following characteristics: — Acidity, 15.9; Specific weight, 0.9374; Refractive index at 40°C., 36; Saponification index, 274.1; Iodine index, 31.8; REICHERT-MEISSL index, 3; POLENSKE index, 33.5.

The oil has a particularly high content of volatile fatty acids, which are mostly insoluble in water.

The fruit of the elm also contains an abundant supply of a fat-splitting diastase.

518 — A New Drying Oil Extracted from the Seeds of *Conepia grandiflora*. — BORTON E. R. and REVES C., in the *American Journal of Pharmacy*, Vol. XC, p. 727, 1918; Summary by BRIDEL M., in the *Journal de Pharmacie et Chimie*, Year III, Series 7, Vol. XIX, No. 4, pp. 107-108, Paris February, 1919.

A new oil has been extracted by the authors from the seeds of *Conepia grandiflora* (fam. Rosaceae), a native of Brazil, where it is known as « oiticica » or « oilizika ».

The seeds are oval, with a reddish colour like those of the cacao plant, and have a quite special aroma; they weigh 3.5 gm. on the average and easily split in two. They contain an average of 62 % of oil.

This oil, pale yellow in colour and semi-solid at ordinary temperatures, rapidly absorbs the oxygen of the air and solidifies: 4 % of its weight after heating at 100°C. for 3 hours, in a thin coat; the varnish thus formed is insoluble in petroleum ether, chloroform and acetone. A solution of the oil in benzine, spread on a smooth surface, gives a uniform and transparent coating.

The constants of this oil are: — Iodine index, 179.5; Saponification index, 188.5; Free fatty acids (as oleic acid), 5.7 %; Unsaponifiable matter, 0.91 %; Density at 15.5°C., 0.9694. The refractive index at 40°C. is too large for the scale of the ZEISS butyro-refractometer; it is, therefore, an oil possessing quite special properties which the authors think could be utilised in the varnish and linoleum industries.

519 - Work on the Retting of Textile Plants in Italy — CARBONE, D., Anaerobic retting (Preliminary Note), in *Igiene moderna*, Year IX, No. 10, October, 1916 — CARBONE, D. and TOMBOLATO A., Rustic retting of hemp, Second Note, in *Le Stazioni sperimentali agrarie italiane*, Vol. IV, p. 563, Modena, 1917; Third Note, *Ibid*, Vol. II, Pt. 9-12, pp. 355-361, 1918. — C. D., Ramie fibre, in *Il Piacentino*, Series, III, Years VII., No. 4, p. 75, 1918 (1) (Summary by Dr. CARBONE).

The term "retting" (freeing the fibres by the dissolution of the cells uniting them), used to describe processes in which recourse is had to purely physical and chemical action, is reserved *sensu strictiori* to the operation consisting in exposing textile plants to microbial action the nature of which is not clearly understood, the operation usually taking place under water or even under soil (retting by burying) or on the surface (retting in the fields). Of these various kinds of *rustic retting*, the one most used, at any rate in Italy and for hemp, is that of submersion under water. But, though it has many advantages, it also has several disadvantages, owing to which methods have for some time been sought for in order to replace this rustic process by an equivalent one, but of an industrial nature. The processes suggested to this end can be divided into physical, chemical and microbiological. Of the latter some depend on the use of anaerobes, others on the use of aerobic organisms. The latter are employed in MARNIER's method in which an organism belonging to the *B. subtilis* group and isolated by MARNIER, is used (chiefly for flax), and in the similar method worked out by ROSSI (2), who essentially uses his *Bacillus Comesi*. As Sig. CARBONE had isolated from bread leaven a bacillus obviously analogous to the latter, he has studied its morphological and cultural characteristics very closely, comparing it with *B. asterosporus* (from the KRÄL collection) and describes its characters side by side with those of similar organisms described by other workers (*B. Comesi*, *B. Kramer*, *B. macerans*, *Clostridium*, an aerobic nitrogen-fixer of S. ROSENBLATT LICHTENSTEIN & H. PRINGSHEIM).

From this comparison the very close relationship uniting all these bacteria in a single group (the only one that is a little distant is *Clostridium*) is quite evident; but agglutination with specific serums clearly differentiates the only two organisms to which the author would apply the test, that is, his own and *asterosporus*. Both produce acetone (like *macerans*) and both, in retting hemp, only produce reduction phenomena without any perceptible change in the reaction of the medium. Both can ret textile plants (hemp, flax, ramie, nettle, mulberry). This retting, for CARBONE's organism as for *asterosporus*, *Comesi* and MARNIER's bacillus, takes place easily when the plant to be retted is immersed in a thin layer of liquid with a large surface, while, if the liquid is deep, air will have to be passed through it to start and regulate the retting (the methods invented by MARNIER and ROSSI are based on this fact). This was formerly taken as a proof that the retting process in question was aerobic, but Sig. CARBONE states that his bacillus

(1) As a supplement to the bibliography and for the summary of other publications: See R., Oct. 1917, No. 956 and R. June 1918, No. 192. (*Ed.*).

(2) See Prof. ROSSI's article: The Industrial Retting of Textile Plants by Microbiological Action, in R. August 1916, pp. 1067-1075. (*Ed.*)

rets flax and hemp and decomposes the potato, producing acetone, even under perfectly anaerobic conditions (rarefied hydrogen). This lends more probability to the hypothesis that the organisms of the *asterosporus* group might play a part in the rustic retting of hemp taking place under essentially anaerobic conditions, but the researches on retting-ponds carried out by CARBONE and TOMBOLATO with the help of CARBONE's improvement on the BREDEMANN method (cultivation of the pasteurised material on potato under anaerobic conditions) have given constantly negative results. On the other hand, in the course of a group of orientation tests attempting to throw light on the way in which a current of air acts in favour of retting, it was found that on the one hand, retting in presence of the organism is still more favoured by a current of hydrogen; while, on the other hand, when operating on unsterilised hemp, if the retting takes place in the absence of air, it gives the fibres special qualities (little or no viscosity remarkable suppleness and whiteness) opposed to those obtained with a current of air; so that, even without the presence of the bacillus, hemp rets, though not so evenly and, under anaerobic conditions, presents the above mentioned characteristics.

Owing to this fact the author undertook a long and careful examination of the flora of hemp retted in this way, evidently under the action of organisms introduced by the hemp itself and unequally distributed on the stems. The microorganisms isolated from this material by means of various nutritive media and under aerobic or anaerobic conditions, were inoculated into hemp kept under aerobic or anaerobic conditions. In the first place the author found a parallelism between the presence of the power of retting and the richness in *Amylobacter*. In this way he obtained, by successive concentrations, apparently pure cultures of these organisms in which it was very difficult to find a few rare specimens of an organism not belonging to the genus *Amylobacter*; but the *Amylobacter* organisms, isolated in numbers in pure cultures on anaerobic agar or must plates (BEIJERINCK & VAN DELDEN method), were found to have no retting power whatever.

It should be remembered that the few workers who have previously described, and sometimes even used industrially, the anaerobic retting bacteria, have always qualified them as *Amylobacter*, and also that the other workers had cast doubts on the real purity of these amylobacterial cultures owing to their having found them inactive after successive transplantations and having themselves isolated non-retting *Amylobacter*.

The author next turned his attention to some slender bacilli that did not stain blue with iodine, and obtained colonies of them, finding as a result, that it was really these organisms that produced the retting. He obtained cultures free from aerobic organisms (short streptococci, probably lactic ferments, are particularly difficult to eliminate); but he was never able to exclude *Amylobacter*, even in small numbers, which for various reasons may belong to a special form of the organism in question. It is a slender bacillus, sometimes in chains, forming spores like *Clostridium* and *Plectridium* with subterminal, oval, elongated spores (vegetative forms measuring $0.3 - 0.4 \mu \times 3.5 \mu$; free spores measuring $1.5 - 2 \mu \times 3 \mu$) and form-

ing round, irregularly stellate, orange-coloured colonies on agar-must and agar milk, and deep cavities covered with a thin, bright-yellow layer on potato; it is strictly anaerobic when alone, but, in symbiosis with aerobic organisms, it lives easily in liquids in contact with the air; the author has named it *Bacillus felsineus*. It rets textile plants (hemp, ramie, flax, etc.), but with different phenomena from those of retting produced by aerobes of the *B. asterosporus* group.

For example, when retting hemp by *B. felsineus*, the bark comes away of itself in wide strips from the fibre, while the cells of the other cortical tissues fall to the bottom, leaving the strips of fibre white and bare; however, when retting this plant with organisms of the *asterosporus* group, the bark if left alone would remain where it is, and it is only by vigorously shaking the recipient that the bark ravel off, still leaving the green tissues adhering to the fibres, so that to detach them they must be washed and rubbed energetically. It is worth remembering that the type of retting done by *B. felsineus* is so similar to that of rustic retting as to be almost identical.

MM. CARBONE and TOMBOLATO have also given the results of seeking for *B. felsineus* in numerous materials with the object of establishing both its natural habitat and its relation to the rustic retting of hemp.

The authors have found this bacillus present with remarkable constancy not only on the above mentioned unretted hemp stems, but also: occasionally on retted hemp in the hemp fields; in the mud and surface coverings in hemp or flax retting pits actually in use or abandoned for several years in different parts of Italy, in the mud of water communicating with the retting-pits. They found that the bacillus gradually increases in numbers in the water of a hemp retting-pit in use, keeping pace with the progress of the retting of the hemp immersed in the pit. This bacillus was, however, never found in numerous samples of mud from running and stagnant water nor in open soils, selected by the authors in various regions of Italy, so far it has not been possible to establish whether it exists outside the retting pits.

After having obtained *B. felsineus* in the state of purity previously described, the authors were able to ascertain that its optimum temperature is rather 37°C. than 28 or 30°C. (temperature of retting-pits in the country). On this basis, and owing to the facility with which the organisms can be grown in aerobiosis, in the presence of aerobes (among which *Saccharomyces ellipsoideus* was found very suitable), the authors attempted to use it in the industrial retting of hemp and other textile plants which, under ordinary conditions are treated by other means or neglected. These experiments, still being carried on, are mostly unpublished, especially those that have given good results with fair amounts of textile plants in industrial establishments, by the order and under the auspices of superior authorities. The results have been published of the small scale experiments, which gave positive results with several colonial textile plants (ramie, several agaves and *Furcraea*, two *Sansevieria*, one *Yucca*, several Malvaceous plants) and some wild European plants little used as textile plants (bark of mulberry branches, wild mallow, broom, nettle).

520 - Kapok as a Substitute for Cotton for Dressing Wounds. — SILHOL Dr J., in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year III, pp. 65-68 + 2 Plates. Paris, November-December, 1918

The author (Professor of Clinical Surgery in the Marseilles School of Medicine) shows the utility, from the French point of view, of replacing cotton by kapok, which is produced in abundance in the French colonies.

From the surgical point of view, the author thinks that, in spite of its short, smooth fibres, gauze for dressings could be made out of kapok; the firm of GRATKY has promised him to make a trial in Indo-China, but at present kapok tissues of good appearance but somewhat coarse, cannot be used generally. For this reason it has been suggested that kapok should be used in its natural state for dressings.

The down is very light; it is said to be 4 times lighter than cotton. In practice, on comparing a dozen kapok dressings with a dozen cotton dressings, it may be said that the kapok dressing is twice as light as the cotton one. Thus, with equal weights, twice as many kapok dressings would be made as cotton dressings, and, at equal prices, the kapok dressings would only cost half as much as the cotton dressings. Kapok is supple, if it has not undergone a chemical treatment or been stove compressed. It is warm and is apparently an excellent insulator. It is very soft, it is even somewhat elastic, and the dressings do not need applying tightly. It is waterproof, but can be made absorbant. M. L. RIGOTARD (« Préparateur de Chimie » at the « Jardin Colonial ») has obtained absorbant kapok by treating it for one hour at 120°C with soda lye at 0.75° Baumé, and the fibres were apparently unaltered by the treatment. The waterproof quality of kapok does not apply invariably, as ether, alcohol, oil of turpentine and vaseline oil pass through it; it soaks up soap water, soda lye, saponin; it also soaks up wound secretions whether they are irrigated (Dakin, serum, aromatic solutions) or not; the pus formed does not pass through it but microorganisms and leucocytes become orientated along its fibres.

Chemists will probably produce a cheap absorbant form of kapok, but this may not be very desirable, and crude kapok, simply freed from the seeds and fanned, will serve as a dressing.

The author entirely replaced cotton by kapok for 8 months at the Hospital of the Jardin Colonial.

The author gives directions for the preparation and sterilisation of kapok dressings.

521 - The Physico-chemical State of the Protein in Cow's Milk — PALMER I. S. and SCOTT R. G., in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 2, pp. 271-284 + 5 Tables. Baltimore, February, 1919.

The authors filtered through Pasteur Chamberland filtering tubes under pressure fresh skim milk, skim milk mixed with 5 % of chloroform, skim milk mixed with 0.05 % of formaldehyde, and skim milk mixed with lactic acid. The total protein content passing through the filters was determined in each case by precipitation with ALMEN's tannic acid reagent, and the non-protein nitrogen in the filtrate from the precipitate thus formed.

It was found that the casein-free protein of the filtrate never exceeded 10 % of the casein-free protein content of the original sample ; generally it was much below this figure. Moreover, the non-protein nitrogen of the original milk could only be partially recovered from the milk mixed with chloroform or formaldehyde.

A comparison of the results obtained by the authors with those of other workers showed the size of the pores of various Chamberland filters to vary greatly, so that conclusions from experiments including filtration must be drawn with reserve. The authors believe the albumin of skim milk to occur in the colloidal state, and that it does not form a true solution, as would appear to be the case when it passes through a filter with insufficiently fine pores. This was shown by the fact that, in their investigations, most of the proteins other than casein were held by the finer-textured filters.

522 - **The Bacterial Flora of the Whey from "Grana," Cheese.** — DALLA TORRI, G. in *Le Stazioni sperimentali a varietà italiane*, Vol. I, Pt. 9, 12, pp. 317-354, Modena, 1918.

The study of the bacterial flora of whey is important in so far as it reflects that of the corresponding cheese.

The author first reviews previous work : — by SPALLANZANI (1888), who was the first to propose for making « grana » cheese, the inoculation of the milk with whey obtained from carefully made cheese ; by FASCETTI, who determined the quantity of serum-ferment or serum-graft to be added to the milk in the vat and found a method for controlling the fermentation of serum to be used as a graft and for propagating it ; by GORINI, who opposed the use of serum-graft, recommending the use of selected ferments. He next describes his researches in the Bacteriological Laboratory of the Experimental Cheese-making Station at Lodi ; they include the bacterial analysis of whey and the examination of the corresponding cheese when it was sufficiently ripe to allow of a sure judgment. The chief facts observed are given below.

The lactic bacteria in the flora of whey are more or less frequently represented by various types of the *Bact. casei* of FREUDENREICH. But for greater simplicity, the author divides the lactic rod-shaped organisms into 2 classes : *coagulating*, which coagulate milk in a time of varying length, rarely more than 4 days, without producing gas ; *coagulating gas producers*, which only coagulate milk after a long time or even not at all, and which always produce gas, some in small, others in large, quantities.

The gas-producing coagulating bacteria can be distinguished from other similar gas-producers (*aerogenes* and *coli*) by numerous physiological and morphological properties and especially because they are anaerobic.

The taste produced by the coagulating bacteria, which usually is clearly acid, is, in some cases, slightly or even obviously bitter ; it is probable that the coagulating rod-shaped organisms with this bitterness, cause bitterness when they are numerous in the cheese. The numbers per c. c. of the microorganisms occurring most frequently in the whey are given in the following Table :

Numbers per c. c. of the commonest microorganisms in whey from "grana" cheese

Date of the analysis	Number of the serum	Coagulating Bacteria	Coagulating gas producers	<i>Bact. lactis</i> <i>acidi</i>	Saccharomyces and Torulas
March 6	25	2 000	21 000	8 000 000	22 000 000
April 23	26	10 000	60 000	27 000 000	10 000
May 24	27	10 000	20 000	9 000 000	10 000
June 29	28	50 000	30 000	1 000 000	600 000
July 8	29	2 300 000	400 000	50 000 000	2 000 000
August 31	30	6 000 000	1 000 000	11 000 000	Not counted by mistake
September 15	31	3 000 000	2 000 000	11 000 000	2 300 000
October 11	32	20 000	900 000	5 000 000	100 000
November 8	33	130 000	200 000	7 000 000	6 700
December 18	34	70 000	90 000	10 000 000	22 000
January 8	35	20 000	10 000	16 000 000	14 000
February 17	36	3 000	9 000	3 000 000	2 700

It will be seen from the Table that during the warm months the content of lactic bacilli is much greater than during the cold months, and while the coagulators predominate during the warm season, the coagulating gas producers dominate in the cold season.

The quantity of *Bact. lactis acidi* varies greatly, but it is always high. Certain bacteria often assume the form of diplococci or streptococci, often in very long chains, occasionally some of them have stringy properties. The form of *Bact. lactis acidi* varies, but there are two main types — 1) quite round or slightly elongated — 2) very close to the rod shape.

The *Saccharomyces* and *Torulas*, with a few exceptions, occur in the greatest numbers in the warm season. Of the other microorganisms those occurring most frequently are the cocci (white and yellow rods (liquefying or not) and spore forming bacteria.

Those cheeses were found of bad quality whose whey contained too many *acrogenes* and *coli* bacteria, or a large number of coagulating gas producers, especially if species were present that produced a great deal of gas. In the first case the cheeses were very swollen, with spongy curd, with a sweetish, unpleasant taste; in the second the cheeses were more or less foliated, usually with a quantity of closely packed "eyes." But it is not the number of gas producing bacteria that influences the quality of the cheese; it is also their energy as gas producers, when they are numerous, but of a stock that is a poor gas producer, the cheese has no defects.

These facts suggest that the coagulating gas producers, to which the normal eyes of "grana" cheese are supposed to be due, can sometimes, if present in large numbers, and still more if they are varieties producing much gas, contribute to form "foliations" ("sfogliature") in "grana" cheese.

As the bacterial flora of the whey is so variable, the use of selected ferments is preferable to that of "serum graft."

- 523 - **Slaughtering Pigs and the Preparation of their Flesh on the Farm.** — ASHBROOK F. G. and ANTHONY G. A., in the *U. S. Department of Agriculture, Farmers Bulletin* 913, 30 pp. + 22 figs. Washington, December, 1917.

This Bulletin urges farmers to consume more home grown meat so as to save by buying less. The subjects treated are — implements used for slaughtering and preparing the meat; slaughtering, preparation of the carcasses; cutting the different parts; preserving, preparation of lard, salting in brine and dry salting, smoking, sausage making, description of a small room for smoking meat; detailed description of a small refrigerator.

- 524 - **Analysis of an Egg Powder.** — GARNIER, L., in the *Journal de Pharmacie et de Chimie*, Year 110 Series 7, Vol. XVIII, No. 12 pp. 353-357. Paris, December, 1918.

For some years a powder made from dried eggs has been on the market, and is now largely used by manufacturers of alimentary pastes. The present scarcity of fresh eggs has led the author to study the exact composition and food value of this powder.

From the organoleptic point of view, it is a clear yellow powder, of peculiar taste, in which analysis has shown the presence of protein nitrogen, organic phosphoric acid and calcium phosphate, the absence of starchy matter or sugar, and the calculated percentage composition of which is: — Water 8.99; Protein, 41.55; Fat bodies and lutein, 25.32; Distearic ecithin, 20.56; Ash, 3.58. The author calculates that an average hen's egg corresponds to 15 gm. of egg powder and that 1 kg. of the powder represents 66½ average eggs.

The author concludes that in times of food shortage and food restrictions, the egg powder can be classed among substitution products of good quality and real food value, the use of which can be recommended to the public in the absence of fresh eggs.

- 525 - **Wools from Morocco** — See No. 413 of this Review.

- 526 - **Rational Utilisation of Animal Carcasses.** — GRABOT M., in the *Annales de Chimie Industrielle et de Chimie Appliquée*, Series 2, Vol. 1, No. 2, pp. 55-65 + 1 Fig. Paris, February, 1919.

The author draws attention to the new conditions of certain industries which were formerly of no account and which, owing to the restrictions imposed by the war, have assumed such an economic importance that they can no longer be disregarded. The by-products of life, like industrial by-products should be taken account of and utilised as far as possible. It is for this reason that the author has made a special study of the knacking industry, which deals with the treatment of animal carcasses, the by-products from various kinds of slaughter-houses and abattoirs, offals meat condemned as unfit for food, fish offals, bones from various sources etc.. In 1903, DE ROCQUIGNY calculated that in France the loss of livestock from accidents and diseases amounted to 30 or 40 million franc. In Belgium, in 1910, MARTEYS estimated these losses at 12 million francs. In Germany, where the knacking industry had assumed special importance, HOFFMANN estimated that, in 1907, 2,500,000

quintals of meat were flayed and dressed while 500 000 quintals were condemned, representing in saleable products, the considerable sum of 25 million francs. A works outside Paris deals every day with 35 thousand kg. of meat of various origins, while another treats 12 000 to 17 000 kg. These figures are sufficient to show the necessity that technical experts should take up the question and find out how to obtain the maximum profit from these by-products, whilst improving the hygienic conditions under which the industry is at present carried on.

The author considers the actual state of the knacking industry in France: — it scarcely exists as an organised industry and is guilty, sometimes, of an absolute lack of hygiene, sometimes of the use of wasteful or imperfect methods, such as, for example, burying animals that might pollute the underground water by infiltration; burning them in the open air, resulting in heavy expenses and slow, and incomplete combustion; cooking of various offals in vats over open fires or in the open air, or in closed vats, methods giving bad yields, as the gelatinous broths, which go bad very easily are generally lost, while there is no guarantee that the cooked meat has been sterilised.

Other and better methods have been suggested with satisfactory results. In one of them the fats are extracted by the use of suitable solvents, such as benzine, petroleum ether, carbon bisulphide, carbon tetrachloride; this process is used in France mostly for removing the fat from bones destined for making glues and superphosphates. Another excellent method, suggested by *AIMÉ GIRARD*, but not very well known, consists in treating the carcasses with concentrated sulphuric acid, cold or hot, at 66° Baumé, by which the animal tissues are completely destroyed, independently of the fat that can be collected; by adding tricalcium phosphate to the acid liquid, a rich manure is obtained free from pathogenic germs, for no bacterium can withstand contact with concentrated sulphuric acid. Very satisfactory results have been given by methods based on the treatment of carcasses in close vats with steam under pressure. The steam under pressure causes the meat to undergo a profound physical change and a partial chemical transforma-

Section of the Hartmann Apparatus.

Explanation of the titles of the section.

Extracteur et appareil à dessiccation — Extractor and desiccator

Vers la pompe à vide — Towards the vacuum pump

Départ du bouillon — Exit of broth

Réservoir à gélatine retournant à l'extracteur — Reservoir for gelatine returning to the extractor.

Séparateur de Graisses — Fat separator.

Récipient intermédiaire — Intermediary recipient

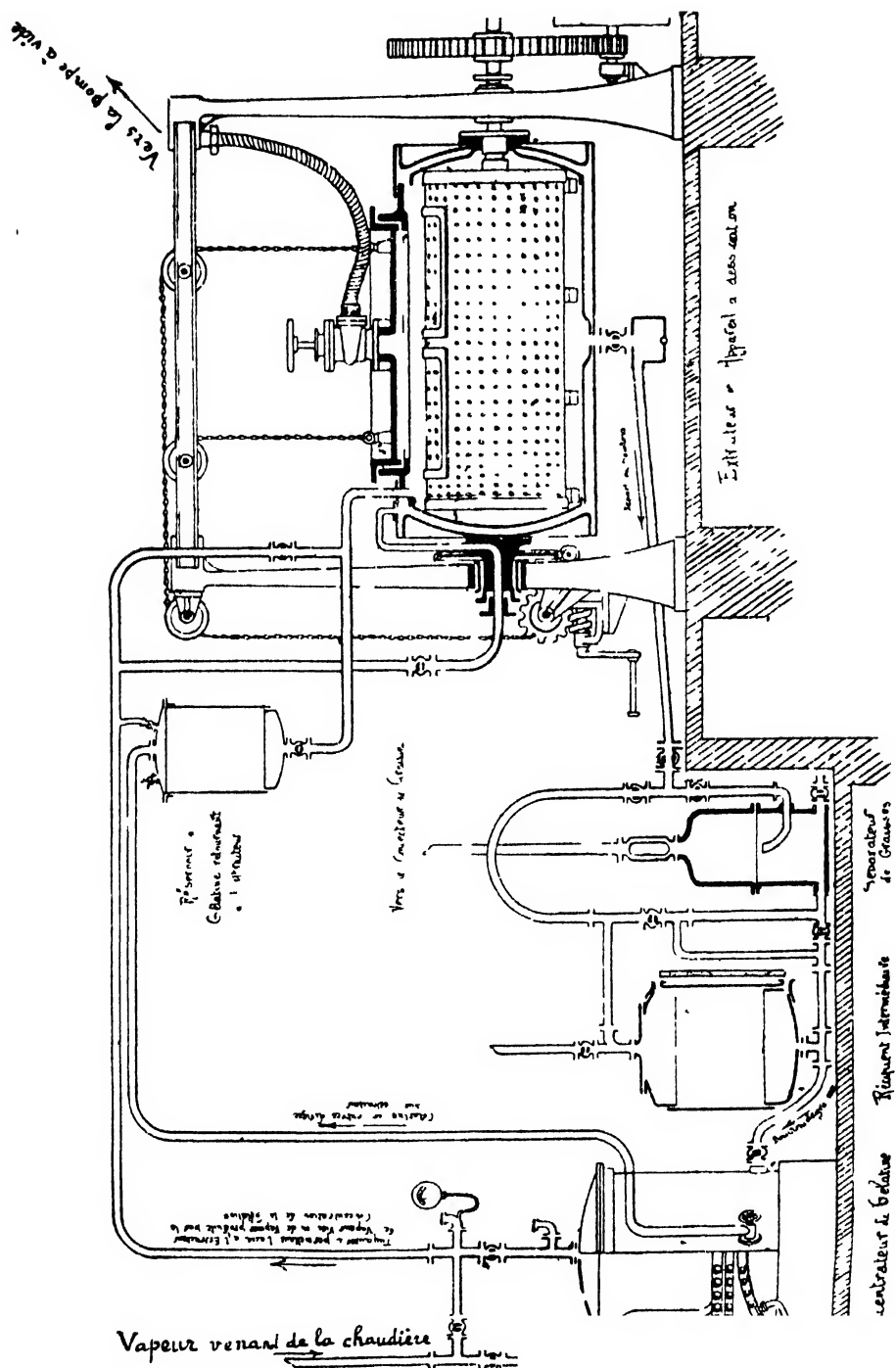
Bouillons dégraissés — Fat-free broth.

Concentrateur de Gélatine — Gelatine concentrator

Gélatine concentrée dirigée sur l'extracteur — Concentrated gelatine passing to the extractor.

Tuyauterie permettant l'accès à l'extracteur de — Tubing leading live steam or steam
vapeur vive ou de vapeur produite par la concen- produced by concentrating the gela-
tration de la Gélatine tine to the extractor

Vapeur venant de la chaudière — Steam coming from the boiler.



tion ; the fat melts completely, the bones lose their content of gelatine and, consequently, their hardness and compact nature, while the meat is completely sterilised ; when dried the meat forms a valuable meal.

Many apparatuses have been made to carry out this treatment. The author considers the general principle underlying the construction of all of them, which is — treating the carcasses in hermetically closed vats by steam under pressure for sufficient time for complete cooking and perfect sterilisation ; separating the fats from the gelatinous broth ; drying the meat and making it into an animal meal of good commercial value. The various improvements introduced into the apparatuses have only the object of enabling the treatment in question to be carried out at a minimum cost and with a maximum yield, and to ensure : — 1) the destruction of all the infectious germs ; 2) the transformation of all the solid or liquid parts of the carcasses that contain organic matter into sterilised products that can be stored, and to make the water contained in the carcasses absolutely harmless ; 3) the treatment of the carcasses of animals that have died from infectious diseases without any previous cutting up ; 4) the prevention of any possibility of newly infecting the finished product by contact with the raw materials ; 5) that no objectionable odours should be given off that might prove a nuisance to the neighbourhood of the works (while ranking them in the first class of dangerous or unhealthy works).

The author next gives a detailed description of one of these modern apparatuses, that of HARTMANN : — the apparatus for extraction and for drying is a large horizontal, cylindrical autoclave with a double lining, mounted on two trunnions and able to rotate at 180° round its axle ; in the autoclave is placed a perforated steel drum moving round the axle of the autoclave and carrying mixers on its periphery ; a door is provided for putting in the carcasses.

The liquids extracted from the raw material under the action of heat drain through a pipe into a recipient (see the appended figure) called a " fat separator " (*séparateur de graisses*) where the fats separate from the gelatinous broth by difference of density and pass towards a collector ; the gelatinous broth freed from fat passes through an intermediary recipient into an evaporator where it is concentrated down to gelatine by means of steam. The steam produced by concentrating the broth is passed to the autoclave, thus diminishing the amount of steam required for cooking and drying, and in this way economising fuel.

The extraction is finished after cooking for 4 or 5 hours ; the drum is set rotating and desiccation begins ; the meat breaks up, passes through the perforations on the drum, is pressed on the fixed walls of the autoclave by the mixers and reduced to a meal. The gases or steam given off during desiccation are removed by a vacuum pump, condensed by contact with cold water or burnt in the grates.

With this apparatus the carcasses are dealt with in such a way that all the operations take place in hermetically closed recipients, at a temperature that produces absolute sterilisation, the steam pressure being at 4 kg.

The carcasses treated in this way yield :-

1) *Pelts* : more or less coloured, but can be bleached and sold to soap makers ; in 1910 the price was 80 francs per 100 kg.; HARTMANN puts it between 50 and 75 francs ; at present it has reached about 380 francs.

2) *Animal meal* : previously only used as a fertiliser ; but scientific experiments have shown that it is quite suitable for feeding pigs, poultry and fish. According to HARTMANN the average chemical composition of this meat meal is : - dry matter, 92 % ; nitrogen, 8 to 9.6 % (corresponding to 50-60 % of crude protein) ; phosphoric acid, 8 % ; fat, 10 to 12 %. Before the war the price of meat meal for food varied, reaching 15 to 22 francs per 100 kg.

3) *Gelatine* : does not go bad, and can be used in making objects moulded in stucco, plaster, etc. ; it can be mixed with some absorbent such as peat, and used as a fertiliser. The sale price of gelatine as such is from 7 to 12 francs ; as manure, its price varies according to its content of nitrogen, phosphoric acid and potash, which varies between the following figures : - nitrogen, 8-9 % ; phosphoric acid, 1.5 - 2.5 % , potash, 1.5 : 2.5 %.

The yield of the HARTMANN apparatus varies within fairly wide limits according to the raw material dealt with. For animals in a normal state HARTMANN gives the yield as : - fat, about 10 % ; degelatinised animal meal 18 % ; gelatine, 6 to 8 %.

The firm of HARTMANN makes various sizes of apparatus : - 500, 750, 1000, 1500, 2000 and 2500 kg. per charge. The total length of the treatment is from 8 to 10 hours for the large machines and 6 to 7 hours for the small ones. One apparatus can be charged twice a day, and, using *pre-war prices* as a basis, a complete plant suitable for treating 3000 to 4000 kg. per day would cost about 60 000 francs, including the buildings. It is evident how the knacking industry is changed by the use of such an apparatus and how important it becomes by enabling the by-products of value to be recovered in a scientific and rational manner.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- 527— **Researches on Potato Leaf Curl in France.** — SCHREIBAU, in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 10, pp. 356-358. Paris, March 22, 1910.

The author presented to the French "Académie d'Agriculture" a report by MM. BLANCHARD and PERRET on potato leaf curl disease.

Experiments carried out during 1918 in the Loire department have confirmed the views previously held by the two workers (1). They have concluded, from their experiments, that nitrate of soda has a certain therapeutic action on plants suffering from the disease, which is certainly the manifestation of a disturbance in the feeding of the plant. In fact, the characters of the disease are precisely those observed in all plants placed under similar conditions, but the chief cause of the trouble appears to be an insufficient supply of nitrogen, and "leaf curl" is apparently related to what is known as "nitrogen starvation". It appears from experimental evidence that the "nitrogen starvation" can date back for several generations which explains why leaf curl is a transmissible disease. From this it will be seen why a tuber obtained from a badly nourished plant, planted in the same region, under similar conditions of soil, manuring and cultivation, continues to degenerate, while when removed to another region, it gives bigger yields and seems to improve. This also explains why, when left in the same region, it improves under the influence of manuring and cultivation.

The two experimenters are continuing their work.

- 528 — **Rust, a Physiological Disease of Cotton caused by Lack of Potash, in the Lesser Antilles.** — See No. 461 of this Review.

- 529 — **On the Dying Off of Spruce (*Picea excelsa*) in the Arve Valley (Chedde and Chamoni).** — MANGIN L., in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V No. 6 pp. 195-204 + 15 Figs. Paris, February 12, 1910.

In May, 1917, Commandant MANGIN reported to the "Société de Pathologie végétale" of France, the destructive effect of fumes from the Chedde works, situated in the Arve valley, a few miles distant from Flayet-Saint-Gervais, in the Alps.

According to M. MANGIN's observations, the conifers were most attacked, while the broad-leaved trees, except the clumps of birch growing near the works, remained unhurt. Among the conifers, the spruce (*Picea ex-*

(1) See R., December 1917, No. 1229 (Ed.)

celsa), which is particularly sensitive to the fumes from the works is killed in a short time ; however, *Abies* and especially *A. pectinata* and *A. Nordmanniana* resist fairly well, and *Pinus sylvestris* also resists though not so well as the fir.

During the summer of 1918, the spruce in the valley of Chamonix and particularly in Bouchet wood, in the same valley, were reported to be rapidly dying off. Owing to the relative proximity of the Chedde works and the damage caused by the fumes given off, it was feared that the Bouchet wood might also fall a victim to the fumes.

CHEDDE REGION. — The Chedde works manufacture the explosives known by their name which are based on perchlorate of potassium, sodium or ammonium. During the war their production has been intensified and the fumes they give off contain chlorine compounds which, in the presence of water, finally produce hydrochloric acid.

The region suffering from the fumes given off by the works includes an elliptical area whose large diameter, parallel to the Arve, is 19 kilometres, from Fayet-Saint-Gervais to Servoz, and whose small diameter is 4 kilometres. The damage noted does not surpass the level of 900 metres, the bottom of the valley being a little under 700 metres.

In this zone the broad-leaved trees apparently do not suffer, except the birches and alders situated within a radius of 100 to 200 metres around the works ; further away, they are healthy. The acacias are normal, even in the park round the works ; it was noticed however, that those on the sides of the road above the works appear to have smaller leaflets than is normal.

The shrubs and bushes of every kind : — hawthorn, various kinds of thorn, dog-berry, privet, viburnum, holly, etc., appear to be immune, even near the works.

The pines are attacked most. Spruce is the least resistant, and it dies 4 to 6 years after the yellowing of the new leaves that is one of the first symptoms of attack.

Abies pectinata and *Pinus sylvestris* are more resistant, although the pine seems less so than the fir. So far no injury to the yew and larch has been reported.

The author has found that the resistance of the silver fir (*Abies pectinata*) and the Scotch fir (*Pinus sylvestris*) is due to a system of defence produced in the living tissues owing to the stimulus of the toxic substances. In *Abies pectinata*, the defence is brought about by the building up of an impermeable wall of cork ; this is the normal reaction of most plants against toxic or parasitic action ; in the pine the means of defence — a quite new one — consists in the secretion of gummy matter that fills the intercellular spaces or other gaps and thus prevents the entry of the toxic substances.

The spruce, although more sensitive than *A. pectinata* and *P. sylvestris*, has not the time to begin a system of defence and its green tissues are rapidly killed by the fumes.

In the area defined above, the spruce are dried up or their foliage slows up rust-coloured against the green of the broad-leaved trees. At the be-

ginning of the attack, the needles of the last shoots first turn yellow throughout their whole length, then they fall owing to the premature formation of a cork cicatrix at their base. All the annual shoots are soon stripped, but the stem and buds remain alive, and the latter open during the summer, giving the trees a peculiar appearance. During the autumn the oldest leaves turn yellow and fall more or less rapidly, the tree dies off more rapidly and at the end of 4, sometimes 6, years it is quite dead. The mortality has increased during the war owing to the greater amounts of explosives manufactured.

Microscopical examination of the leaves of the silver fir and Scotch fir has shown that the toxic fumes do not penetrate into the tissues in the gaseous state through the stomata, for the regions near the guard cells of the stomata show no signs of damage. It is brought about by the mists, whose drops of water, after having dissolved the toxic substances, gather on the leaves, cling to their ends and gradually penetrate into them, from the point towards the base. In fact, the defensive tissues in the needles of the fir or pine are always oriented in a transverse direction.

This observation is very important, as it excludes the possibility that the injurious drops might be carried very far from the works.

CHAMONIX REGION. - There are numerous clumps of spruce in good condition in the region between Servoz and Chamonix. Small areas can be seen here and there where the foliage is yellow and a few trees are dying; but in these places it can easily be seen that *Ips typographus* ("bostriche") has been causing damage. It is only near Houches that spots can be seen that really somewhat those in the clumps poisoned by the Chedde fumes. From Houches up to Chamonix, no trace of any toxic action can be seen in the healthy green of these spruce.

After Chamonix, one reaches Bouchet wood, where the spruce is severely attacked in areas of varying size. Some are dead and have lost their needles, while some have foliage which has partially or entirely yellowed, but whose needles remain on the tree. In no case were any characters observed like those noted on spruce in the Chedde region:—fall of the needles of the last shoot with intact buds that open giving fine green shoots, and remaining thus during the summer, but going yellow and dying with the first fogs.

The author thought that the stripping of the branches in the Bouchet wood occurred late and at the time the buds were dried up and incapable in the ordinary course of events of producing new shoots.

On certain trees, even when still green, numerous lichens (*Ramalina*, *Evernia*, *Parmelia*) are sometimes seen, thus demonstrating a poor state of vegetation, but with the exception of a few saprophytic fungi, no traces of parasitic invasion can be seen on the aerial part. The very variety of the organisms harboured by the branches and sometimes by the leaves, shows that they have nothing to do with this disease of spruce.

Examination at the foot of dead or dying trees has disclosed neither the presence of *Ungulina annosa* (*Trametes radiciperda*) (1) nor that of *Trametes Pini*, which also attacks spruce.

(1) Syn. *Fomes annosus*, (Edl.)

We are, therefore, in the presence of a physiological disease of as yet uncertain origin.

In any case, it may be taken as certain that the hypothesis of the injurious influence of the fumes from the Chedde works should be set aside in the case of the diseased spruce in the Bouchet wood.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS. .

530 — Virgin Soil Containing Fungi Capable of Attacking Certain Plants — See No. 428 of this Review

531 — The Relation of Potato Scab (*Oospora Scabies*) to Soil Reaction: Investigations in the United States. — GILLISPIE L. J. and HURST L. A., in *Soil Science*, Vol. VI, No. 3, pp. 219-230 + 1 Figs. + Bibliography of 23 Publications. Baltimore, September, 1918

An examination of numerous soils from the north of the State of Maine, U. S. A., showed the appearance of scab of the tubers of potatoes to be closely connected with the reaction of the soil as measured by the hydrogen-ion concentration of its solution. This disease is rare in acid soils, in which the hydrogen-ion concentration (expressed by SORENSSEN's formula P_H (1) is below 5.2, but is common in soils, the P_H of which appreciably exceeds this figure, especially in those with an alkaline reaction, (with a P_H above 7) (2) The limit $P_H = 5.2$ can, naturally, not be considered as absolute, but is fairly common in many different soils and differs little from that assigned to the development of *Oospora scabies* in experimental culture media in the laboratory.

Potatoes and other market garden crops have been successfully grown in numerous soils with a P_H equal to 5.2 without liming. This shows that potatoes can do well in certain soils without the application of quantities of lime making their reaction neutral ($P_H = 7$), or even slightly alkaline (P_H above 7), contrary to the assertion of SHARP and HOAGLAND. This result is of great importance because liming, by decreasing the acidity of the soil, favours scab. It also shows that it is not possible to assign to the lime requirement of the soil a limit as definite as $P_H = 7$ (neutrality), but that this limit must be determined experimentally for each case with specific crops.

(1) For the definition of this term see R. Feb., 1919, No. 159 (Ed.)

(2) These facts confirm the statements on this subject in STEVENS and HALL, *Diseases of Economic Plants*, New York, 1910, p. 268. Scab of tubers is found particularly in very moist soils with an alkaline reaction. The fertilisers which tend to increase the alkalinity of the soil (wood ash, potash, soda, farm-yard-manure, lime, etc.) favour the development of *Oospora Scabies* and aggravate the disease in soil already infected. Fertilisers which increase the acidity of the soil (super-phosphates, ammonium sulphate, potassium salts other than carbonate, etc.), help by this very effect to decrease the disease. On the other hand rotation helps to decrease soil infection, so long as not only potatoes, but also other plants liable to be infected by *Oospora Scabies*, such as beets, turnips, and cabbages are excluded. The effect of rotation is heightened by any cultural method which will increase the acidity of the soil, especially digging in green manure. (Ed.)

To measure with certainty the soil reaction by means of the hydrogen ion concentration it is necessary to know thoroughly the precision of the methods used to determine this concentration. The authors compared the results obtained by the electrometric and colorimetric methods respectively (1) and found them to agree in the limit of experimental error. To make determinations with air-dried soil 1 to 2 c. c. of water per gramme must be added, but this addition does not appreciably decrease the sensitiveness of the methods.

RESISTANT PLANTS

532 — **Rust-Resistant Oats in Texas, U S A** — See No. 416 of this *Review*.

533 — **Disease-Resistant Coffee Plants in Indo-China.** — See No. 466 of this *Review*.

MEANS OF PREVENTION AND CONTROL

534 — **Sulphur Lime Washes.** — VERMOREL and DANTONY, in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. IV, No. 5, pp 161-164 Paris, February 5, 1919

Washes made from sulphur and lime are extremely valuable. They are the only ones of practical use against "leaf-curl" and "leaf-spot"; they also destroy scale-insects.

In America, they are used in every orchard; Prof. MARCHAL, in his work on the American Experiment Stations, has drawn attention to their value and the advantages of using them.

There are many formulae for preparing lime-sulphur washes, but in most cases these washes are uncertain in their effects, produce serious scorching and do not always give the results expected of them.

After having found, by numerous experiments, that the way in which they are used had little influence, it occurred to the authors that the differences in action and properties were due to differences of chemical composition, and for this reason they have studied the factors that might cause the composition to vary.

To this end, M. DANTONY has carried out over a thousand analyses at the Villefranche Viticultural Station, and both authors have made hundreds of experiments.

At present they only give the chief conclusions they have arrived at, and refer those who require more detailed information to a paper where the work is fully dealt with.

Sulphur-lime washes may contain the following substances:

a) in solution: calcium hyposulphite, carbon tetrasulphide, calcium pentasulphide, oxysulphides of calcium;

b) in the sediment: sulphur, lime, calcium sulphite, calcium sulphate and calcium oxysulphide.

(1) A comparison of these two methods made by L. J. GILLESPIE is described in *R.* July, 1910, No. 733. For the determination of the hydrogen-ion concentration see also. *R.* Aug., 1918, No. 839, and *R.* Nov., 1913, No. 1204; W. M. CLARK and H. A. LUBS, The Colorimetric Determination of the Hydrogen-Ion Concentration and its Applications in Bacteriology, in the *Journal of Bacteriology* 1917, Vol. II, pp 1-31, 109-136, 191-236. (Ed.)

All the other substances reported present, such as lime in solution, sulphhydrates, hydrosulphohydrates, etc., were not found.

The relative proportions of the dissolved constituents vary with the following conditions : — 1) temperature of heating ; 2) duration of heating ; 3) relative proportions of sulphur and lime ; 4) quantity of water ; 5) duration of cooling ; 6) surface exposed to the air and, consequently, the shape and capacity of the vats used in making it ; 7) impurities in the lime and especially the presence of magnesia ; 8) quantity and nature of the sediment.

Temperature of heating. — 1) At ordinary temperatures and after contact lasting several months, oxysulphides of calcium, calcium hyposulphite and a little calcium tetrasulphide are formed ; 2) the quantity of soluble salts formed increases with the temperature up to 100°C. ; at low temperatures calcium hyposulphite is mostly formed ; at high temperatures sulphides predominate ; the result is that the absolute quantities of hyposulphite keep on increasing, while the percentage of this substance in relation to the sulphides diminishes.

Duration of heating. — 1) The content of dissolved sulphur increases with the time of boiling for 45 minutes, then decreases ; 2) at first, tetrasulphide is formed, and pentasulphide afterwards appears progressively.

Proportions of lime and sulphur : — 1) with the proportion of 3.2 of sulphur to 1 of calcium, the maximum of sulphur in solution is obtained ; both above and below these figures, the quantity of sulphur diminishes ; 2) above 2.9 of sulphur to 1 of calcium, a mixture of tetra- and pentasulphide is obtained.

Proportion of water. — The fractions of sulphur and lime which dissolve increase as the quantity of water increases up to 3.1 of water to 1 of sulphur-lime mixture ; above, the fraction dissolved decreases.

Duration of cooling. — The proportion of calcium hyposulphite decreases the more the cooling is slow.

Surface exposed to the air. — The greater the surface exposed to the air the more calcium hyposulphite is formed.

Magnesia : — The magnesia causes considerable losses of sulphur and results in sulphuretted hydrogen being given off ; magnesian limestones should, on this account, not be used.

Nature of the sediment : — The presence of an excess of lime in the sediment leads to the formation of oxysulphides of calcium.

From these indications it may be concluded that it is very difficult, in agricultural practice, to control at one and the same time all the above factors and to obtain products of constant composition, without being guided by a chemist with experience in the matter.

The density of the solutions is not closely related to the content in sulphur, and it consequently cannot be used as a safe criterion.

In using lime-sulphur washes, the ordinary sprayers made of red copper should not be used as they deteriorate rapidly. Aluminium and certain kind of brass should be used as they resist sufficiently in practice to last well.

DISEASES
OF VARIOUS
CROPS**535 - A Preliminary Note on a Bacterial Disease of Foxtail in Arkansas, U. S. A. -**ROSEN H. H. in *Science N. S.*, Vol. XLIX, No. 1264, p. 291, Lancaster, Pa., March 21, 1919.

From September, 1918 till the following mid-November, near Fayetteville, Arkansas, was observed on the leaves, flowering stalks and glumes of foxtail (*Setaria glauca* [L.] Beauv.) a disease distinguished by oval or round spots 1 to 2 mm. in diameter, and streaks 2 to 3 cm. long. Both the spots and the streaks were dark brown in colour. The disease seems fairly widespread round Fayetteville, and is most probably prevalent in Arkansas State at least.

The bacterium causing the disease was isolated and pure cultures of it obtained. It was inoculated into healthy leaves by means of a sterilised platinum needle and by spreading the bacteria over the leaves. Two or three days later the characteristic brown coloration of the tissue was observed at the points of inoculation. The bacterium was again isolated and grown in pure culture of the artificially inoculated points.

The bacterium was successfully inoculated into wheat, oats, rye, barley, maize and Sudan grass, both by spraying and by application with platinum wire. It was re-isolated and obtained in pure culture from each of these hosts. Judging by the appearance of the infected plants in the green-houses in which the experiments were made, all the Gramineae tested, except maize and sorghum, are liable to be very seriously attacked by the bacterium, which probably corresponds to *Pseudomonas Avenae*, Manns. Further investigations are, however, necessary to identify definitely this bacterium.

536 - The European Potato Wart Disease Discovered in Pennsylvania -SANDERS J. G. in the *Monthly Bulletin of the State Commission of Horticulture*, Vol. VIII, No. 1, pp. 10-12 + 3 Figs., Sacramento, California, January 1919.

The European potato wart disease (*Chrysophlyctis endobiotica* Schilb) (1) was recently discovered in the anthracite mining district of Pennsylvania in 28 towns near Hazleton, where it is found in the gardens of the miners. The introduction of the disease can be traced directly to the importation of potatoes from without during the years 1910-1912, i. e., before the prohibition to import potatoes.

Fortunately the villages in which the disease occurs are surrounded by vast stretches covered with *Quercus ilicifolia*, *Vaccinium*, and wild plants, cultivated land being absent. Moreover, as, in these towns, the consumption of potatoes greatly exceeds the production, there is little danger of spreading the disease by means of the tubers. This is the first time this disease has been reported in the United States.

537 - *Phytophthora cryptogea* n. sp., Peronosporaceae Injurious to Tomato and to other Plants in Ireland -PRYTHYBRIDGE H. G. and LAFFERTY H. A. in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XV, (N. S.), No. 35, pp. 487-505 + 3 Plates, Dublin, 1919.

At the beginning of the summer of 1916 specimens of diseased tomato seedlings were sent from a nursery in the suburbs of Dublin to the Seeds

(1) See R. Jan., 1914, No. 76; R. Feb., 1914, No. 182; R. Oct. 1914, No. 956; R. Aug., 1916, No. 938. (Ed.)

and Plant Disease Division of the Irish Department of Agriculture for examination. A preliminary examination showed the disease to be of a new type. A visit to the nursery showed that it had been first observed three years previously on a few isolated plants. The second year it had become worse, and the third almost half of the seedlings in the nursery were already either dead or dying. Later the same disease was found, always on the tomato, in two other nurseries and a few private gardens of the same district, as well as in different parts of Ireland. This shows it to be fairly common in Ireland; according to the authors it also occurs in England.

As a result of the disease the root-system and lower part of the stalks of young plants are attacked by a rot which eventually kills them. The authors propose to call the disease "tomato root rot".

A species of *Phytophthora* has been isolated from the diseased tissues and shown to be the specific agent of the disease. It has been grown in pure cultures. Its reproduction organs (antheridia and oogones) resemble those of *Phyt. erythroseptica* Pethyb. and *Phyt. infestans* de Bary. The fungus has, therefore, rightly been placed in the genus *Phytophthora* and, as it is not identical with any of the known species (*Phyt. erythroseptica*, *Phyt. infestans*, *Phyt. Phaseoli* Thaxt., *Phyt. Arecae* (Colem.), *Phyt. parasitica* Dast., *Phyt. Colocasiae* Rac., *Phyt. Allii* Law., *Phyt. Melongenae* Saw., *Phyt. terrestris* Sherb.), it is described as a species new to science under the name of *Phyt. cryptogea*.

The same type of disease caused by the same fungus has been observed on plants of the *Petunia* genus. It is most probable that the same fungus also causes a similar disease on *Aster* and *Cheranthus*. Artificial inoculation has shown the fungus to be pathogenic to the potato, *Gilia tricolor*, and *Fagus sylvatica*, but not to *Senecio vulgaris*, *Helianthus annuus* and *Nicotian affinis*.

The plants contract the infection in the soil by their roots. The oospores probably hibernate in the soil though this has yet to be definitely proved. The disease may be avoided by growing the tomato in soil completely sterilised by heat. In many cases infested plants can be treated by removing and burning the diseased parts and planting the remaining healthy parts as cuttings in uninfected soil. If these precautions are not taken all the diseased plants will have to be burnt. The soil in which diseased seed plants have been grown should be removed, and all vessels and buildings in which such plants have been cultivated should be carefully cleaned and disinfected or sterilised before being used again.

538 - **Pink Root of Onions in Texas, U. S. A.** — TAUBENHAUS J. J. in *Science*, N. S., Vol. XLVI, No. 1261, pp. 271-278, Lancaster, Pa., February 28, 1919.

In Webb County, Texas, there is a very serious disease of onions known as pink root. It was reported for the first time in 1917 by the author, whose attention had been drawn to it in 1915. The disease is seated in the bulb and attacks the roots given off by it. These roots turn first yellowish, then pink, and finally dry up. As the old roots die off new ones appear and are attacked in their turn. The bulb thus exhausts itself in the production of

new roots which all become infected, and loses its commercial value. Bulbs the roots of which are attacked by the disease, remain small, though in every other way they appear healthy. It is estimated that the annual loss from this disease in Webb County is 40 %.

Investigations have shown the disease to be caused by a new species of *Fusarium* called by the author *F. Malli* Taub. Numerous laboratory and field experiments gave the following results :

- 1) The disease is propagated by the infected parts of the bulbs.
- 2) It may be transmitted from year to year by remaining in the soil ; short rotations with crops other than onions in soil infected by *F. Malli* do not destroy the parasite .
- 3) In addition to onions, garlic and shallot are also attacked by the disease, but other Liliaceae appear to be immune.
- 4) sterilisation by steam kills the fungus in the soil ; formaldehyde at the rate of 1 pint in 20 gallons of water per square foot also kills the parasite in the soil.
- 5) Lime does not give satisfactory results
- 6) In infected soil, abundant manuring especially with substances easily assimilated by the plant together with suitable cultural methods, make it possible to obtain almost normal crops ; in this case the fertiliser acts simply as a stimulant to the bulb to form new roots before the disease can destroy them.
- 7) Fertilisers rich in nitrogen and organic matter are especially useful for soils infected by *F. Malli*.
- 8) Healthy bulbs planted in infected soil contract the disease ; diseased bulbs planted in healthy soil produce diseased bulbs.

539 - *Colletotrichum erumpens* and *Phyllosticta straminella*, Deuteromycetes Injurious to Rhubarb, in Illinois, U. S. A. — STEVENS, F. L., in the University of Illinois, Agricultural Experiment Station, Bulletin No. 213, pp. 299-312 + 20 Fig. Urbana, Illinois, 1919.

Two serious diseases of rhubarb have been discovered recently in the State of Illinois and named respectively by the author " rhubarb anthracnose " and " rhubarb leaf-spot ".

The former, attributed to the pathogenic action of *Colletotrichum erumpens*. Sacc., consists in a soft rot of the petioles alone. The spots on the petioles are usually soft, watery, translucent and oval, with the chief axis placed along the length of the petiole. When the spots are more than a centimetre long, the small black stromas of the parasite appear in abundance in the centre. When the infection is advanced, all the petiole is covered with stromas and is entirely soft and rotten.

On the market, only the less serious cases are seen, represented by petioles with many small spots of rot that passed unnoticed by the grower when preparing the rhubarb for market.

The disease is usually much more abundant on the old parts of the plant than on the fresh and vigorous parts, although many vigorous and saleable stalks are attacked.

The infection has been found at Champaign and Urbana (Champaign county) at Kankakee and Bourbonnaise (Kankakee county) and near Anna (Union county) ; it is apparently widely distributed.

The damage caused by the disease is of three kinds : — the slightest trace of disease in a bundle of rhubarb offered for sale makes it practically impossible to sell it to a sharp buyer ; in the field many stalks that could otherwise be sold, have to be discarded on account of the rot ; the premature death of the infected stalks and, consequently, of the leaves, weakens the normal strength of the plant.

The second disease, caused by *Phyllosticta straminella* Bres., was first found abundantly in a plot at Bourbonnaise. There, nearly all the leaves had numerous spots produced by the fungus, the spots often covering more than half the surface of the leaf.

Differing from the disease just described, this one does not principally attack the old leaves, but the relatively young leaves can be seriously attacked.

Phyll. straminella particularly attacks the leaves, but it has also been found on the petioles and stems. The chief characteristics on the leaves consist in the presence of irregularly circular spots of dead tissue, with a well defined edge and a diameter varying from a few millimetres to several centimetres. The zone of dead tissue is tan-coloured and often dry and cracked or torn. Close examination shows the presence of numerous, very small, brown pycnidia. On the petioles and stalks the spots are oval, quite hollow and absolutely dry. Occasionally a spot may spread the whole length of the petiole, occupying only one side or part of a side of the petiole itself.

Besides Bourbonnaise, the disease was found at Urbana, Kankakee and Champaign.

When many leaves are seriously attacked by the disease, the plant is very much weakened.

The author gives information as to the morphology, cultural characters and systematic position of these two fungi.

540 - *Entyloma Calendulae*, a Basidiomycete injurious to the Dahlia in Belgium. — STERNON F., Une maladie nouvelle du dahlia, 6 pp., 1 pl. Brussels, Published by Leprince 1918.

In October 1918, there were observed on the leaves of plants of *Dahlia variabilis* and its-hybrids, growing in a nursery garden at Gembloux, small, circular, scattered, discoloured pale patches, which subsequently increased in size and number, and became confluent and brown, and surrounded by a darker-coloured zone. These patches finally invaded the whole surface of the lamina, sometimes even attacking the petiole. Often the altered tissues of the patches withered, so that the leaves became riddled with holes. The large number of these patches produced a disturbance of the chlorophyll functions, which caused the leaves to wither rapidly and completely, much to the detriment of the young floral shoots, and even of the entire plant.

The petioles attacked by this disease, bent, turned first yellow and

then brown, and finally withered completely. When the last stage was reached, the affected leaves rolled up and fell to the ground.

The examination of the abundant material collected has permitted the writer to ascertain that the disease described above is due to *Entyloma Calendulae* (Oude) De By. In order to control it, all the dead leaves that have fallen since the autumn should be carefully collected and burnt. The affected portions of the plants ought to be removed and burnt, and even entire plants, or varieties, if severely attacked, should be destroyed in like manner.

As it is probable that the mycelium of the fungus passes the winter in the tubers of the host-plant, it is advisable to have recourse also to internal disinfection of the tubers, either by means of heat (hot air, or hot water) or immersion in suitable anticyptogamic solutions (copper salts, formalin, corrosive sublimate).

541 — *Researches on the Pathology of the White Mulberry, at the Experiment Station for Sericulture at Padova Italy* — Sci. No. 500 of the *Rivista*

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

MEANS OF PREVENTION AND CONTROL

542 — *Blastothrix britannica* n. sp. and *Aphycus melanostomatus*, Hymenoptera Parasitic on the Coccid *Lecanium capreae* in Great Britain. — *Trans. A. D. in The Quarterly Journal of Microscopical Science*, Vol. 63, Pt. 3, N. S., N. 1917, pp. 93-271. Fig. A. 31. London December 1917.

This paper gives a morphological and biological study of two Chalcidids known to be parasites of the coccid *Lecanium capreae* (1) — *Blastothrix britannica* Guérin sp. and *Aphycus melanostomatus* Timb. According to NEWSREAD (1903) the coccid is very common in England, but is found more especially in Scotland and Wales. The author found it less abundant in the South of England than in the Northern Midlands. It is common throughout continental Europe (MARCHAL 1908) and occurs also in North America. The principal host plant is hawthorn, and most of the observations described in the paper under review were made on material taken from this tree. The author also found the coccid on lime and hazelnut trees, and a few specimens on horse-chestnut trees, sweet gale, and apple trees. NEWSREAD and MARCHAL mention other hosts.

B. britannica has two generations a year with about equal numbers of males and females. The first generation of adults is from larvae which liberate and appear in May and the beginning of June. The female lays one or more eggs in the body of the fully developed young host. The larva of the chalcid pupates in the body of the coccid towards the end of June. As many as 42 pupae have been observed in the body of one *Lecanium*.

The second generation of adults which is more numerous, appears during the first three weeks of July. The female lays its eggs in the very young larvae of the coccid, depositing one egg in each larva. The larvae from these eggs undergo modifications similar to those of the larvae of the

(1) See *B.*, Feb., 1915, No. 183; Jan., 1917, No. 116; Feb., 1917, No. 159.

first generation, but hibernate in the bodies of their hosts and pupate as a rule in April of the following year. The chalcids from these pupae form the first generation of the year.

A. melanostomatus also has two annual generations, and the different phases of its life history correspond almost with those of the preceding species. The males are, however, less abundant than the females and occur approximately in the ratio 1 : 3. The first generation emerges between the beginning of May and the middle of June. The eggs are deposited in the body of the young adult coccid. The larvae pupate within the body of the host. From 1 to .48 specimens have been found in a single *Lecanium*.

The adults of the second generation emerge about the same time as those of the preceding species, and, like them, lay their eggs in the very young larvae of the coccid. The larvae of the chalcid hibernate and give birth to the first generation of the following year. A third partial generation of adults has been observed.

The effect of the first* generation of parasites in the host is similar for each of the two species of chalcids. From an economic point of view they are negligible. On an average 53% of *L. capreae* is attacked, but the infested insects succumb to the attack only after having laid their eggs. So far the parasite has not been found to exercise an inhibitory action on the laying powers of its host. The effects of the second generation of the parasite are, however, complete; about 40% of the host are attacked and die before reaching sexual maturity. The second generation of parasites is very important, because it restricts the numbers of the host which, as a result, rarely occurs in numbers large enough to constitute a pest, in spite of its great fecundity.

543 Experiments and Observations carried out in Italy on the Chief Methods for Combating Locusts (1) — PANFILI F., in *L'Entomofauna italiana*, June-V. 1914, pp. 215-305. Modena, 1915.

The author has been commissioned since 1916 by the Ministry of Agriculture with the direction of the control of locusts in the provinces of Rome and Caserta and thus has been able to test, in these regions, some of the chief methods for the control of locusts in use in Italy and other countries.

The use of *Coccobacillus Acridiorum* d'Hér. which, according to the author, really should be called *Bacterium Acridiorum* causes too slight a mortality among the locusts (*Docostaurus maroccanus*) to warrant its consideration as a practical means of control.

Gathering the egg-cases is a cheap method when the number of insects destroyed are considered, but it can only be done where there are more than 100 egg-cases per sq. metre and, in addition, it has the disadvantage of completely destroying the pasture.

The ploughing of the "grillare" (places where the egg-cases are laid) followed by a winter cereal crop totally destroys the egg-cases and costs nothing. For this reason it is the best method, though indirect, for the

(1) See R. Ann. 1915, pp. 52-53; See also "La lotta contro le cavallette durante l'estate" in *Int. Ann. of Agric.* Rome, 1916. (Id.)

control of locusts, on land that can be cultivated and, in this case, the author thinks it should be made compulsory by law, a Commissioner being appointed to enforce the application of the method and control the work.

Catching the locusts is a primitive method that should be given up, as it is too costly, requires too much labour in a season when the labourers are busy with other important farm work, and leaves too many locusts alive to lay their eggs.

Caustic sprayings with an emulsion of heavy tar oil destroy a good proportion of locusts (an average of 50 %), but they cost too much, as they, too, require a lot of labour, eat the sprayers away rapidly, and make the pasture unfit for use a month before the usual time and destroy the hay. The emulsion of heavy tar oil made on the spot costs less than the manufactured emulsion ("cresosol") but with it apparatus and a staff are required that are not always available.

Spraying the grass on which the locusts feed with a dilute solution of arsenite of soda kills nearly all the locusts and costs much less than caustic sprays, as it needs less labour and does not harm the spraying machines; it does not destroy the hay, but the pasture cannot be used until after the first rain.

By spreading bran poisoned with arsenite of soda among the grass, all the locusts are killed and this is probably the best direct method of control, as it is the least expensive of all, requires very few workmen, does not need a spraying machine, harms neither pasture nor hay and can be applied at any season.

544 - Patents Relating to the Control of Diseases and Pests of Plants — See No. 100 of this Review

INSECTS, ETC.,
INJURIOUS
TO VARIOUS
CROPS

545 - *Popillia japonica*, a Coleopteron Injurious to Various Plants Introduced from Japan into New Jersey, U. S. A. - FRICKERSON P. L. and WILSON H. B., in *The Canadian Entomologist* Vol. 4, No. 7, pp. 217-221, 1 Fig. London, 1915

The authors report the presence of an injurious scarabæid from Japan *Popillia japonica* Newm., in the south of New Jersey State, where it was first discovered in a nursery in August, 1916. When found the insects were feeding on leaves of *Ampelopsis quinquefolia*, plum, vine, *Sambucus*, *Crataegus*, and *Cephalanthus*, and were also in and on flowers of althea, spiræa and *Vitex Agnus-castus*. The damage done by *P. japonica* is similar to that caused by *Macrodactylus subspinosus* Fabr. and other scarabæidæ but the destruction of the leaves is much more complete. The insect also feeds on *Polygonum virginianum*, *Tinaria arifolia* and *Oenothera biennis*, the leaves of which are sometimes riddled with holes as a result of the attack. *P. japonica* also attacks, but to a lesser extent, leaves of *Ambrosia*, sp., *Abutilon*, *Artemisia*, *Impatiens* sp., and flowers of *Asclepias syriaca*.

It should be noted that numerous ornamental, agricultural and horticultural plants in the immediate neighbourhood of those mentioned were

not attacked at all by the parasite. The insect, which is very injurious, especially to leguminosae, in Japan, was probably introduced into New Jersey about six years ago in the larval stage in soil containing iris rhizomes coming from Japan.

The infestation in New Jersey is being carefully watched. Attacked plants are sprayed with lead arsenate and the insects collected by hand. Seriously infested *Ampelopsis* plants have been entirely freed from the insect by spraying. Dead *Popilia* have not been found on the soil under sprayed plants, but careful observation has shown insects of both sexes in the soil in a state of torpor which had apparently been affected by the insecticide used.

546 - *Gonocephalum hofmannseggii* and *G. depressum*, Coleoptera Injurious to Crops in Mysore, India. COLEMAN, I. C. and KUNHIKANNAN, K. in the Department of Agriculture, Mysore State, Entomological Series, Bulletin No. 5, pp. 1-16 + 2 Figs. + 2 Plates Bangalore 1915

Gonocephalum (Opalrum) hofmannseggii and *G. depressum* (ground beetles) are both common in the State of Mysore. The larvae generally attack the roots of gramineae, and the adults feed on decomposing vegetable matter. Both the larvae and adults may, however, attack summer crops, such as the potato. The larvae also do damage to *Eleusine coracana* ("ragi") in districts where the precipitation is insufficient when rain falls after sowing and the larvae do not find the moisture they need to construct the small cells of earth in which they pupate.

The biological cycle of these insects usually ends within one year. The larval stage occurs only in the hot season. The adults, which emerge after the first heavy rains, remain inactive till the following December, when reproduction begins. In years in which the first heavy rains are followed by a drought lasting two or three months, there may be a second generation of the insects.

The beetles may be controlled by collecting the adults in October. Fresh weeds pulled up by their roots are spread on the ground and the beetles collect amongst them in large numbers. In addition to birds, their natural enemies include a mite, which lives on the adults, and two hymenoptera. One of these latter was seen carrying a beetle larva to its nest; the other is an ichneumonid, living parasitically in the larva of the host. These enemies are not however sufficiently numerous to prove really efficacious as means of control.

547 - *Acanthoscelides trabutii* n. sp., a Coleopteron Injurious to *Vigna Catjang*, in French West Africa. — CAILLIOT, H., in the Bulletin de la Société entomologique de France, No. 3, pp. 53-54 Paris, 1919

Description of the new beetle *Acanthoscelides trabutii*, belonging to the family Bruchidae (syn. Lariidae), discovered by Dr. L. TRABUT in seeds of the leguminous plant *Vigna sinensis* (— *V. Catjang*), from Timbuctoo (French West Africa).

- 548 - *Helix pisana*, a Dangerous Snail Introduced into California.** - GORTON G. R., in the *Monthly Bulletin of the State Commission of Horticulture*, Vol. VIII, No. 1, pp. 27-31 + 4 Figs., Sacramento, California, January, 1919.

Helix pisana was first reported in America towards the end of 1918 in an uncultivated district of San Diego County, California. This mollusc belongs to the Gastropod class and is well known in the Mediterranean regions of Europe and Africa for the great damage it does to cultivated plants. It attacks particularly the branches, flowers, and young leaves of citrus trees, the foliage of the olive tree and loquats, etc.

Steps were immediately taken to destroy this snail in the infested zone, where it was extremely abundant on the wild vegetation, and recourse was had to burning.

In spite of careful investigation it has not been possible to discover how the snail was introduced into California.

- 549 - Insect Pests of the Avocado in California.** - CONDRIT I. I. in the *Monthly Bulletin of the State Commission of Horticulture*, Vol. VIII, No. 1, pp. 27-39 + 4 Figs., Sacramento, California, January, 1919.

Up to the present the avocado (*Persea gratissima*) in California has been free from attack by insects which, in other countries, do it serious injury (1). Nevertheless it is attacked by insects of secondary importance. Near Saratoga, in May 1918 the ting-borer (*Polyaon confertus* Lec.), which pierces galleries in the branches near the leaf axils was found on a small avocado (var. Harman). The branches attacked were broken off and burnt, and the tree inspected frequently. This insect had already been observed on avocado in Ventura County in 1915. At the same time the foliage of the plant was attacked by the June beetle (*Serica alternata*) at Fillmore. Near Carpinteria, in May, 1917, the author found avocado leaves infested and discoloured by *Heliothrips haemorrhoidalis* Bouché, and, at the end of October, 1918, in the same district, this insect damaged the fruit as well as the leaves of many plants.

In July, 1918, near Duarte, the mealybug (*Pseudococcus citri* Risso) was noticed on an avocado which was subsequently removed. In the following October the same coccid was found on other avocados both near where the first specimen had been attacked and at a good distance away. It occurred at the branching of the branches, twigs and leaf axils and on the stems of the fruit. Already in September, 1914, this insect had been reported as injurious to avocado in some parts of Ventura County.

In 1915, in various localities of Southern California, wherever there were nurseries or young avocados, there occurred, in addition to other pests, an undetermined insect which bores galleries in the bark of the soft branches; on one occasion the insect was found attacking a leaf. The branches attacked should be removed and burnt.

(1) See R. Apr. 1912, No. 669; Feb. 1913, No. 190; Aug., 1914, No. 707; Dec., 1914, No. 1195; May, 1916, No. 501; June, 1917, No. 607 (*Fd.*).

550 - *Moreschiella moricola* n. subgen. and n. sp., a Dipteran Injurious to the Mulberry, in Italy. — DEL GUERCIO G., in *L'Agricoltura Coloniale*, Year XII, 2nd. Half-Year, No. 6. pp. 345-354 + 9 Figs. Florence, 1918

Description, followed by brief biological notes, of the dipteran (fam. Cecidomyiidae) *Moreschiella moricola* n. subgen. and n. sp., found injuring the mulberry (*Morus alba*) at Notaresco in the province of Teramo

The larvae hatching from eggs laid in the axils of the young branches bore into them and feed until they change into the perfect insect.

Where the branches are attacked, the bark shows more or less elongated dead patches that are more or less enveloping and become very evident in May, the leaves wither and finally die.

It is not yet certain whether the parasite has only one or several generations a year.

To control the attack the branches affected should be removed in May and June.

551 - *Moreschiella roburella* n. sp. and *M. ilicicola* n. sp., Diptera Injurious to the Oak and Holly Oak respectively, in Italy. — DEL GUERCIO G., in *L'Agricoltura Coloniale*, Year XII, 2nd Half Year No. 6 pp. 358-369 + 11 Figs. Florence, 1918

The author records as new to science, under the names of *Moreschiella roburella* and *M. ilicicola*, two species of Cecidomyiid diptera, which, in Tuscany, attack *Quercus Robur* and *Q. Ilex*, respectively.

The author describes the larva, male and female, of *M. roburella*; he only describes the larva of *M. ilicicola*.

The larvae of the two species live in the cupules and inside the acorns of their respective plant hosts

INTERNATIONAL INSTITUTE OF AGRICULTURE
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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

552 - **Agricultural Conditions in Mesopotamia.** - *Indian Engineering*, Vol. LXV, No. 2, p. 19 Calcutta, Jan. 11, 1919

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

Mesopotamia with its arid climate and its two rivers is an ideal country for irrigation operations. The general character of the soils in the valleys of both the Tigris and Euphrates is that of a light calcareous loam; and where there are noxious salts there should be no difficulty in reclamation, provided that the supply of water is bountiful. Success in washing out the soluble salts in Egypt was attained under less favourable conditions. Nitrogen is said to be about as high as in the average soils of Egypt. Potash is present in more than average amount, and phosphoric acid is found in sufficient quantities for the growth of ordinary crops without the application of manures. There are moreover rich porous clays and alluvial soils in the lowlands through which the rivers run.

In the winter months, from November to May, the cereal crops, wheat and barley, are indicated, in fact it is known that these crops succeed admirably. The pulses should also do well and winter forage would present no difficulties. There is no doubt about maize and the millets, and summer forage of certain kinds. Rice can be cultivated with success as is known by experience, sugar cane on the richer soils, and there is no reason why cotton, possibly Egyptian cotton, should not form a large item of the cultivated area. Garden produce, vegetables and certain fruits, would also do excellently. Oranges and melons are already grown, grapes would probably succeed, and the climate is suitable for dates.

553 - **Cattle Raising and Agriculture in Ecuador.** - GODING, F. W., in *Supplement to Commerce Reports*, Annual Series, No. 439, 1918.

Live-stock statistics are a great desideratum in Ecuador, as even an estimate of the number of cattle, horses, sheep, etc., is of little value owing to there being no reliable basis to figure from. Three years ago a live-stock census was arranged for by the Government, but the plans were not carried out. Some idea of the number of cattle at present in the country may be obtained from the following information:—

About 40 000 cattle hides were made into sole leather during the past year, 100 000 were exported, and 50 000 were locally used, making a total of 190 000 hides. A fair average of the cattle killed, the world over, is 15 per cent of the whole, which gives an approximate total of 1 267 000 cattle in Ecuador.

Some high-class breeding cattle imported into the Quito district are improving the herds of the coastal districts. As few cattle diseases exist and as land is cheap, Ecuador is an ideal country for cattle raising. The same may be said for hogs and goats, and sheep do fairly well. Rabbits and guinea pigs are now being bred as a source of meat which promises success, and there is a bright future for the breeding of fowls of all classes.

With the exception of the region near Quito, agriculture in Ecuador is in a very primitive stage. Some progress is promised, however. During 1918 the Agricultural Association called an American expert to make a preliminary study of an unknown disease which was ruining the cacao trees and fruit. The work was so satisfactory that the association has signed a five year contract with the expert to devote his entire time to the question. Coupled with this arrangement an agricultural experimental station is to be organised which doubtless will include experts in all branches of agricultural and horticultural science, together with animal husbandry. Should these plans be completed, Ecuador will be in a position to handle satisfactorily all questions relating to this industry.

Ecuador is the home of the cinchona tree and of numberless medicinal plants; when attention is properly directed to this source of national wealth, a large number of these plants will be placed under cultivation, with benefit to the grower as well as to the world in general.

Many curious and valuable Ecuadorian vegetables and fruits at present unknown to the American table are being investigated by the United States Department of Agriculture with a prospect of being brought to the notice of seed growers and made available to the American people.

A Commission organised by the Smithsonian Institution is at present making a thorough study of the botanical resources of Ecuador which will be invaluable to the horticulturists of the United States.

RURAL HYGIENE

554 - On the Phosphorus and Nitrogen Contents of the Water in which Vegetable Food Products are Boiled. — MASONI, G. and SAVINI, E., in *Le Scienze sperimentali avanzate italiana*, Vol. LI, Pt. 9-12, pp. 362-414. Modena, 1918

In an earlier work on the food value of wheat flour and bread (1) Signor MASONI already showed the importance of phosphorus compounds in food in general. He pointed out the great solubility in water of the phosphorus (and nitrogen) compounds of the foods examined and drew attention to the possibility of quantities of phosphorus too large to be ignored passing into the water in which various foods of vegetable origin are boiled, and being lost.

The authors show, in the first place, that the amount of utilisable phosphorus ingested with food is not sufficient in all rations to meet the re-

(1) See *R S p* ember 1915, No. 661. (1 d)

quirements of the organism. Thus, if a man eating exclusively 1 kgm. of bread a day, ingests an absolute quantity of nitrogen (corresponding to 100 gm. of protein) above that necessary to normal food requirements, he only absorbs 300 mgm. of phosphoric acid, or 131 mgm. of phosphorus, an amount barely corresponding to that excreted in the urine. These conditions are about the same for a diet of bread and "polenta" (maize flour), bread and fruit, or chestnut flour, etc., so common in many districts. The phosphorus compounds of food should be considered when studying the value of food suitable to men and animals as not of less importance than the other constituents which hitherto have been taken into consideration almost exclusively.

To determine the proportion of phosphorus and nitrogen compounds which may be removed in the water in which vegetable foods are boiled, the authors examined the nature, distribution, solubility, and food value of these compounds.

1) *The nitrogenous substances* which may be present in vegetables are proteins, amido compounds, alkaloids, nitrogenous glucosides, ammoniacal salts and nitrates, and enzymes. The proteins include: — a) simple proteins, albumin, globulin or edestin, vitellin, and nucleo-albumin (phosphoric albumin); b) complex proteins, e. g. nucleoproteids.

The vegetable albumins are soluble in water and neutral solutions (e. g. sodium chloride), may be precipitated by acid solutions, and coagulated by heat.

The vegetable globulins are insoluble in water, soluble in dilute solutions of a neutral salt (e. g. common salt) of an alkali, or an acid.

The vegetable vitellins are insoluble in water and saline solutions, soluble in dilute alkalis, and precipitated by acids, even if only traces of them are present.

Nucleo albumins are insoluble, but the salts they form with alkaline metals are soluble.

Nucleo-proteids are soluble in water, especially boiling water, and in salt solutions; they are very soluble in alkaline fluids.

Amido-compounds (amino-acides and anides) form the greater part of the protein-free nitrogenous substances of plants; the most common are asparagin (soluble in water, especially if boiling), and glutamin.

Alkaloids, glucosides, and enzymes are usually soluble in water.

Nitrates and ammoniacal salts are stimulant food substances under special conditions only.

2) *The principal phosphorus compounds* contained in vegetables are phytin (very soluble in water, especially boiling water), lecithins (insoluble in water), nucleo-albumin, and inorganic compounds.

The products studied by the authors were chosen from those most commonly used in such a way as to include all the organs of the plants (roots, stem, shoots, leaves, flowers, fruit, and seed) as well as industrial products (macaroni). To exclude any influence from the composition of

Number	Product	Quantity of substance used gm.	Quantity of water used cc.	Duration of cooking or maceration	Condition of water in which the product was boiled
				minutes	Clear but coloured
BOILING EXPERIMENTS.					
Vegetables;					
1	Red cabbage	204	1500	60	
2	Spinach,	312	300	15	"
3	Chicory	100	300	15	"
4	Asparagus, } green part	161	1000	30	"
	} white part	22.80	1000	30	"
5	Cabbage.	251	1500	45	"
6	Artichoke	113.50	500	45	"
7	French beans	150	800	30	"
8	Potatoes	230	1000	60	"
9	Red Beet.	150	500	120	"
	} root	224	500	15	"
	} leaves				"
Caryopses and other seeds:					
10	Commercial white rice (1915)	50	500	15	thick
11	Rice (1917)	50	500	45	"
12	Idem (filtered liquid)	50	500	30	clear
13	"Risella" (1915)	50	500	15	thick
14	Dried white beans (large)	100	1000	150	"
15	Dried white beans (small)	100	1000	150	"
16	Idem (filtered liquid)	100	1000	150	clear
17	Yellow beans	100	1000	150	thick
18	Dolichos	100	1000	150	"
19	Idem	100	1000	210	"
20	Lentils	100	800	120	"
21	Chick peas	100	1000	150	"
22	Idem	100	1000	210	"
23	Dried chestnuts (1st sample)	100	800	150	"
24	Idem (filtered liquid)	100	800	150	clear
25	Dried chestnuts (2nd sample)	100	800	210	thick
Macaroni;					
26	"Nastrini,, (1915)	50	1000	10	thick
27	"Capellini,, (1917)	100	1000	10	"
28	"Lasagne,, (1917)	100	1000	15	"
29	"Nastrini,, (1917)	100	1000	10	"
30	Idem (filtered liquid)	100	1000	10	clear
MACERATION EXPERIMENTS					
Caryopses and other seeds:					
31	Rice (1915)	50	300	2	thick
32	Rice	50	300	48	"
33	Rice	50	300	72	"
34	Dried white beans (small)	100	500	24	clear
35	Dried chestnuts (2nd sample made into flour)	20	300	24	clear fill

Percentage of various constituents in the crude product						Percentage of each constituent removed in the water used for boiling			
Moisture	Organic matter	Mineral matter (ash)	Phosphoric acid	Corresponding phosphorus	Nitrogen	Organic matter	Mineral matter (ash)	Phosphoric acid	Nitrogen
89.020	9.160	1.600	0.199	0.087	0.770	32.71	61.33	45.00	19.08
94.316	4.180	1.504	0.159	0.068	0.420	10.17	37.50	24.56	26.05
91.960	6.298	1.721	0.250	0.109	0.462	17.34	48.94	36.37	21.64
89.936	9.132	0.932	0.280	0.126	0.126	21.69	39.74	25.70	87.38
87.780	11.540	0.680	0.154	0.066	0.096	16.89	37.18	84.42	94.06
89.040	9.852	1.108	0.231	0.100	0.770	46.94	67.27	51.43	35.20
85.760	13.296	0.944	0.218	0.096	0.434	25.96	34.72	26.15	23.01
91.056	7.988	0.956	0.262	0.122	0.182	37.14	51.76	53.59	89.32
72.070	26.916	0.941	0.206	0.092	0.210	0.70	6.36	17.17	32.00
88.600	10.668	0.732	0.120	0.052	0.168	21.37	47.85	61.03	42.75
91.140	6.748	2.112	0.264	0.110	0.630	25.45	55.26	36.55	14.29
13.800	85.460	0.740	0.320	0.140	1.400	8.28	71.45	79.29	7.13
11.180	88.214	0.596	0.158	0.069	1.246	9.82	57.72	72.22	14.95
11.180	88.214	0.596	0.158	0.069	1.246	5.84	40.90	49.44	14.04
14.000	85.540	0.460	0.332	0.144	1.428	1.81	78.35	21.00	5.16
13.240	83.140	3.620	0.873	0.380	3.080	9.20	29.43	29.21	12.99
13.260	83.360	3.380	0.832	0.363	3.402	21.66	44.59	50.31	16.17
13.260	83.360	3.380	0.832	0.363	3.402	9.09	41.10	33.54	11.02
12.660	83.336	4.004	1.070	0.481	3.668	9.54	36.20	33.55	9.49
11.800	85.300	2.900	0.985	0.432	3.006	15.18	69.11	33.59	13.84
11.800	85.300	2.900	0.985	0.432	3.006	9.53	34.12	17.71	10.52
13.600	83.840	2.560	0.963	0.420	3.962	11.36	56.48	45.69	15.35
11.360	86.028	2.612	0.621	0.271	2.912	15.14	77.27	33.10	18.85
11.360	86.028	2.612	0.621	0.271	2.912	8.75	32.67	15.59	9.11
12.660	85.340	2.000	0.481	0.210	1.230	24.65	58.69	45.38	16.28
12.660	85.310	2.000	0.481	0.210	1.230	6.76	58.11	39.05	—
8.064	89.284	2.652	0.480	0.210	1.120	16.29	31.96	27.82	15.08
10.400	88.900	0.700	0.409	0.179	2.250	6.61	61.47	22.20	6.08
10.580	89.404	1.016	0.446	0.197	2.030	12.09	37.23	30.62	12.33
11.100	87.800	1.100	0.847	0.371	2.321	5.57	49.31	45.97	15.2
9.880	89.128	0.992	0.712	0.323	2.030	7.96	55.50	31.25	10.59
9.880	89.128	0.992	0.742	0.323	2.030	5.61	52.27	30.18	5.92
13.800	85.460	0.740	0.320	0.140	1.400	1.85	71.20	76.48	5.29
13.800	85.460	0.740	0.320	0.140	1.400	1.85	71.20	76.48	5.29
13.800	85.460	0.740	0.320	0.140	1.400	2.02	90.63	76.48	6.15
13.260	83.360	3.380	0.832	0.363	3.102	2.32	17.35	29.70	2.70
8.064	89.284	2.652	0.480	0.210	1.120	32.64	82.24	90.96	42.57

the water and to obtain data of generic value, distilled water was used for boiling and no salt or other compounds added. Ordinary enamelled iron vessels with lids were used. The fresh and dry vegetables and chestnuts were put on the fire in cold water, the rice and macaroni were thrown into boiling water.

At the same time as the cooking experiments the authors made some of digestion in the cold (average temperature 22° C.) in distilled water; the liquid separated by filtration was analysed. The results of both experiments are given in the appended table. They are given also for the substances dried at 100° C, and the ratio between the nitrogen and phosphorus in the crude substance, the water in which it was boiled, and the boiled substances, calculated.

The results show that large quantities of useful substances may pass into the water in which vegetable products are cooked. The loss of organic matter is not very high for rice and macaroni, but increases for the other products, especially vegetables, in which it is sometimes $\frac{1}{3}$, or even $\frac{1}{2}$. The loss of organic substances is less the more starch is present. Potatoes boiled in their skins only lose minute quantities.

When the filtrate from the water in which rice, beans, chestnuts, and macaroni were boiled was examined separately it was found that, for organic matter as a whole, there may be great differences between the thick liquid and the filtered liquid, whereas, for the mineral matter as a whole, in every case, and for the phosphorus and nitrogen, in three cases out of four, the differences were very small. This shows that the useful substances removed by boiling are really soluble or, at least, pass into the colloidal state.

Other experiments were made in which boiling was prolonged till the liquid was fairly concentrated. It was found that, after normal boiling, dolichos and chick peas lose almost twice as much useful matter as after boiling continued till the liquid is very concentrated. This is because vegetables cooked for a long time absorb part of the substances dissolved in the concentrated liquid.

The great losses observed after treatment in the cold make it seem that the indispensable washing of vegetable food products causes the loss of appreciable quantities of useful substances.

The ratio between nitrogen and phosphorus calculated in the water in which the products are boiled is, except in a few cases, lower than the corresponding ratio calculated in the raw substance, thus showing that, during cooking, relatively more phosphorus than nitrogen is lost.

What has been said of the nature of the nitrogen and phosphorus compounds of plants and their solubility throws light on the nature of those which may pass into the water used in cooking. Of the nitrogen compounds this will be above all the albumins and edestins, and the nucleo-albumins and nucleo-proteids to a much smaller extent. Amido compounds are more easily removed by boiling vegetables than cereals. The proportion of nitrogen attributable to the alkaloids, glucosides, and enzymes, must, in every case, be relatively small. It is, however, probable

that in many cases, especially for vegetables, a certain proportion of nitrogen in the water used in cooking is due to nitrates.

With respect to the phosphorus compounds it must be remembered that, in caryopses and other seeds, most of the soluble phosphorus is due to phytin or the decomposition products of phytin, to which much of the soluble phosphorus of herbaceous foods must be attributed. In such foods a relatively large proportion of inorganic phosphorus compounds absorbed directly by the plant or derived from the dissolution of the organic phosphorus combinations of plant metabolism, may also be found.

The small quantity of nucleo-proteids and nucleo-albumin dissolved may help to a slight extent to raise the proportion of phosphorus removed by cooking. The lecithids may be presumed to supply but an inappreciable quantity of phosphorus to the cooking water.

As it is usually indispensable to cook vegetable food in water loss should be avoided by using this water for soups or similar foods, or the least possible water should be used, the water concentrated till it is partially re-absorbed, or boiling done by steam, or over a hot water bath.

555 - The Harm in Using Boric Acid for Preserving Food. — LINDER, in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 10, pp. 315-347. Paris, March 12, 1919.

The use of boric acid for the preservation of food, permitted for butter in England, was expressly forbidden in France. It was authorised in 1916 as an exceptional and provisory measure, for butter and margarine (at the rate of 5%) and for ham and pork by-products.

Boron is contained naturally in food, but the quantity ingested daily by each person is not more than 0.030 gm. If the 50 or 75 gm. of butter or margarine used each day contains 5 per 1000 of boric acid, if the 100 gm. of pastry that may be eaten each day is mixed with 15 % of egg yolks containing 2 or 2.5 %, if the ham contains boric acid, etc., the average ration is considerably exceeded, reaching about 0.5 gm.

The author asked M. KOHN-ABREST, Director of the Toxicological Laboratory of the Prefecture of Police, and M. ALQUIER, general secretary of the Society for Alimentary Hygiene, to furnish him with their bibliography on the subject. This shows that the ingestion of boric acid in heavy doses produces a decrease in weight of man and animals, and particularly a loss of fat, hinders nitrogen exchange and deranges the proper utilisation of the food by increasing the peristalsia of the intestine, thus leading to diarrhoea. The organism only excretes 85 % of the boric acid ingested, including 81-82 % in the urine, 1 % in the faeces and 3 % in the perspiration; 15 % is, therefore, retained and an accumulation of boric acid like that often observed with poisons, is to be feared, allowing for the difference between them. Such an accumulation is to be feared especially with persons whose kidneys act badly.

For these reasons, the author demands that the provisory authorisation to add boric acid to food should be withdrawn as soon as circumstances allow.

556 - The Use of Passive Anaphylaxis for the Detection of Tuberculous Meat. — GRANUCCI, L., in the *Clinica Veterinaria*, Year 42, No. 4, pp. 115-126 + Bibliography of 16 Publications. Milan, February 28, 1919

Work carried out at the Institute of Hygiene of the Royal Veterinary School at Naples. The author briefly considers previous work on anaphylaxis and the use several workers have made of it for the diagnosis of tuberculosis, divergent results being obtained. Thus, Dr. SPARAPANI recently used solutions of muscle juice obtained by macerating for 12 hours, then filtering, and inoculated them into the peritoneum of the rabbit in doses of 1 to 2 cc. After 24 hours he inoculated bovine tuberculin in solutions of 10-2-1 % in the peritoneum or in the veins, at the rate of $\frac{1}{100}$ to $\frac{1}{1000}$ of a cc. for each of them. He states that the results he has obtained both for cases of advanced and medium stages of tuberculosis, enable him to draw the conclusion that anaphylaxis is a valuable diagnostic method for meat inspection.

The author has used Dr. SPARAPANI's method, but he made the injection with a much stronger dose of tuberculin. Moreover, in order to study the transmission or transport of passive anaphylaxis to one of the sensitised rabbits, he bled one after 13 days, defibrinated the blood and inoculated its aseptic serum in 2 cc doses into other normal rabbits, to which he gave, after 24 hours, a second injection with the meat extract previously used for sensitising. Thus he carried out 2 series of experiments:— 1) sensitisation of rabbits with tubercular (bacillary) protein and determination of an anaphylactic state by test injections with a basis of bacillary protein; 2) sensitisation as above, passive transmission of the allergia to other normal rabbits, and determination in them of anaphylaxis by means of albuminous protein. From the results, given in detail in two tables, the author draws the following conclusions:—

1) The muscle plasma of cattle suffering from tuberculosis to an advanced, or even medium, degree, injected once into rabbits, produces a hypersensitive state in them, so that a subsequent injection of tuberculin causes a severe form of a state of passive anaphylaxis.

2) This reaction can be considered as specific, for control rabbits, inoculated with plasma from healthy cattle, either do not react or show very slight disturbances which are of no importance, because they are not comparable to a true state of anaphylaxis, even in a slight form.

3) The condition of anaphylaxis can be transported to other, healthy rabbits, but the morbid form obtained is less intense if albuminous protein is used instead of bacillary protein.

4) In the two cases of passive anaphylaxis, there is always a rise in temperature.

5) Examination for anaphylactic antibodies in meat from cattle suffering from tuberculosis to an incompletely limited and circumscribed degree may be extremely useful for meat inspection, when the meat has to be examined in the absence of the viscera and when the great ganglia of the quarters are not affected or if the suspected meat is already cut up.

557 - How to Become a Colonist: The Maison-Carrée School of Agriculture, Algiers.

— Note presented by M. LOUIS-DOP, Delegate for Algeria, Vice President of the International Institute of Agriculture.

At a time when it is generally recognised that a colonist must have a thorough technical training, the Maison-Carrée school of agriculture deserves special attention. By its immediate proximity to the town of Algiers with its great intellectual and scientific resources, by its equipment and organisation which have recently been greatly improved, by its excellent staff, the School takes its place amongst the best teaching institutions.

Its aim is to give the students the necessary technical and practical knowledge for the rational exploitation and direction of a rural estate or agricultural industry in North Africa and in the other countries of the Mediterranean Basin as well as in other districts. It appeals particularly to young men of Algeria or France who wish to take up agriculture in Algeria or the neighbouring protectorates, and to those who intend growing crops in districts with a climate similar to that of North Africa. Its very inclusive instruction makes it a real school of general colonisation.

The courses extend over two agricultural seasons. The instruction greatly resembles that given by the National Schools of Agriculture, but is adapted to the special conditions for which it was founded. There are successive periods of study at Maison-Carrée and of essentially practical work in the annexes and cooperative cellars, which makes it possible to give the pupils particularly extensive and profitable technical and professional instruction.

The School also helps its students to settle. It gives facilities for them to make complementary studies on estates in North Africa, in the Hamma Experiment Garden, or in the experiment stations which are being formed in different parts of Algiers.

The first six students of each promotion are admitted free of charge to a third year of study in the school laboratories at the Colonial School of Arts and Trades (established at Dellys pending its removal to the estates of the Maison-Carrée School of Agriculture). Those who wish may also complete their studies either in the laboratories of the Faculties, or by following certain courses at the University or at the "Ecole nationale supérieure d'agriculture coloniale" at Nogent-sur-Marne, France.

Thanks to the excellent professional preparation of the students of the School, Algeria, and especially the new protectorate of Morocco, offer them almost unlimited openings -- direction or formation of agricultural farms, posts as agricultural managers or heads, situation in various agricultural industries as well as in the numerous commercial and industrial branches or public services requiring knowledge such as that given at the School.

The School diploma gives a qualification which is taken into serious consideration when free concessions of colonising land are made. Owing to the grant made by the Algerian Government the fees are low (internal: about £27, day boarders £21, and external £12). Students pay an additional £6 p. a. to cover the cost of excursions, apparatus, and breakages.

Scholarships may be granted by the Government of Algeria, the departments and colonies. Candidates must be 17 years of age on entering the School except when special dispensation is given.

The entrance examination takes place on July 11th and 12th, 1919. It includes only written papers and may be entered for in Algeria, France (principal centres), and abroad (French consulates).

Places available after the examination may be assigned at the beginning of the scholastic year to candidates giving proof of a general education superior to the average of that shown by competing students. Free auditory students may be admitted without examination at any time of the year. Information may be obtained from the Director of the School, or the Director of the "Office de l'Algérie", 10 rue des Pyramides, Paris.

558 - Instruction in French West Africa: The School of Agriculture and Forestry; Foundation of the Institute of Agricultural Technology and Scientific Research at Bingerville. — FRANÇOIS, G., in the *Renseignements coloniaux et documents publiés par le Comité de l'Afrique Occidentale Française et le Comité du Maroc*, Year 1919, Nos. 1 and 2, pp. 34-39. Paris, 1919.

As in Indo-China (1), considerable attention is now being paid to education in French West Africa. The author gives the text of the decree of November 1, 1918, and criticises it. This decree fixes the general organisation of education in French West Africa. It provides for:— 1) primary instruction (village and district school, courses for adults); 2) higher and professional primary education (to prepare agents for lower posts in commercial and industrial administration); 3) higher Mussulman primary education; 4) secondary education (colleges or secondary courses); 5) higher technical education (to prepare agents for the subaltern general staff).

Other decrees (November 1918) reorganise the William-Ponty School (instructors of the subaltern general staff), the Faidherbe School Administrative and commercial instruction), the Pinet-Laprade Professional High School (designers, geometers, artisan artists), the apprenticeship courses connected with the Government printing works, the School of Naval Mechanics, the School of Medicine and Veterinary Medicine, and the School of Agriculture and Forestry of French West Africa.

Eight large special schools under the immediate control of the Governor General, for which no expense will be spared either for instruction or staff, will provide higher technical instruction for French West Africa. They will form a kind of West African University the different sections of which will be able to extend their programme or increase their number according to the requirements of the country and the success of the undertaking. They will, however, retain a primarily practical character which will remain in touch with realities, and all the efforts of which will be directed towards improving the lot of the natives.

To speak only of the agricultural question, the French West African School of Agriculture and Forestry will be established at Bingerville, the

(1) See R. Oct. 1918, No. 1068, and R. Nov., 1918, No. 1199. (*Id.*)

chief town of the Ivory Coast. Pupils will be received on leaving Faidherbe and trained for posts as agricultural agents on the subaltern general staff. The School of Agriculture and Forestry will depend on the Institute of Agricultural Technology and Scientific Research which will be established at Bingerville, and will play the same part as the garden of Buitenzorg for Java, Peradeniya for Ceylon, the Bureau of Science for Manila, and the Institute of Girai for Indo-China (1).

CROPS AND CULTIVATION

AGRICULTURAL
METEOROLOGY

559 - General Classification of Climates by Temperature, Precipitation, and the Character of the Seasons. — KÖPPEN, W., in *Petermann's Mitteilungen*, Year LXIV, Pt. 8-pt.-Oct., pp. 193-203; Pt. Nov.-Dec., pp. 213-248 + 1 Map. + 8 Figs. Gotte, 1918

This paper gives a detailed study of the classification and their distribution. This distribution is illustrated by a coloured map. The author bases his classification on two meteorological factors only — temperature and precipitation — and takes into account both their absolute values and their distribution throughout the year. He distinguishes eleven principal types of climate, designated on the map by letters and different colours, a few secondary, or transition types, numerous sub-types, designated by letters or groups of letters. The eleven principal types are :—

I — WET CLIMATES OF THE TROPICAL ZONE

- | | |
|---------------------------------|----|
| 1) Tropical rain forest climate | Af |
| 2) Savanna climate | Au |

II — ARID CLIMATES

- | | |
|-------------------|-----|
| 3) Steppe climate | Bs |
| 4) Desert climate | BWh |

The thermal conditions of these four climates are identical — high temperature throughout the year and no winter ; they differ in precipitation, which decreases progressively from 1 to 4.

III. — TEMPERATE RAINY CLIMATES

- | | |
|--------------------------------------|----|
| 5) Dry winter temperate climate | Cs |
| 6) Warm dry summer temperate climate | Cn |
| 7) Wet temperate climate | Cf |

IV — SUB-ARCTIC CLIMATES

- | | |
|----------------------------|----|
| 8) Wet cold winter climate | D |
| 9) Dry cold winter climate | Dw |

V — SNOW CLIMATES

- | | |
|--------------------------|---|
| 10) Tundra climate | E |
| 11) Eternal snow climate | F |

The bio-sphere (part of the earth where life is possible) lies between two extreme climates — that of the desert (xero-sphere), and that of eternal snow (cryo-sphere). On either side it is bounded by the climate of the steppes (intermediate to the xero-sphere and bio-sphere), and that

(1) For the Institute of Girai see R., Oct., 1918, No. 1918, (Ed.).

of the tundras (intermediate to the bio-sphere and cryo-sphere). In each of these zones life is possible, but much reduced. Thus, the flora of the steppes is composed of a few wild Gramineae only, that of the tundras of mosses.

LIMITS OF THE PRINCIPAL TYPE OF CLIMATE. — The limit of the eternal snows may be considered the boundary line between the cryo-sphere and bio-sphere, that is to say the point at which the amount of snow that falls is equal to the amount that melts, this preventing progressive accumulation. It is difficult to determine this point exactly by meteorological data only, because this phenomenon depends on numerous factors acting in various degrees. In his study the author considers the summer temperature as the predominating factor, and the points at which the average temperature of the hottest month does not exceed 0°C . as the boundary between the bio-sphere and cryo-sphere or, more exactly, the tundra and the cryo-sphere.

To determine the boundary between the biosphere and the xero-sphere, or, more exactly, between the steppe and the xero-sphere, the author uses the following combinations of temperatures (in degrees centigrade) and of precipitation (in cm.) They are based on the fact that, the more the temperature increases, the more evaporation increases and, consequently, the amount of rain necessary to prevent the formation of a desert :—

Temperature		25°	$25-20^{\circ}$	$20-15^{\circ}$	$15-10^{\circ}$	$10-5^{\circ}$	$5-0^{\circ}$
Rainfall	Desert Limit	32	29	26	23	20	16
	Steppe limit	64	58	52	46	40	32

With the exception of the xero-sphere and cryo-sphere, tundras and steppes, all the other parts of the globe have temperatures and rainfalls adequate to the development of arborescent vegetation. They may be divided into three large classes :— 1) *megathermal zone (A)*, with constantly high temperature ; 2) *mesothermal or temperate zone (C)* ; 3) *microthermal or cold zone (D)*. Between *A* and *C* lies the arid zone *B*. The point at which the average temperature of the coldest month is not below 18° separates *A* from *C*, and the point at which the average temperature of the hottest month does not exceed 10° (limit of arborescent vegetation) separates *D* from the tundra zone *E*. The boundary between *C* and *D* is the temperature of the coldest month, — 2° .

In the austral hemisphere, the isotherm — 2° of the coldest month does not apply to the land itself, and is nearer the pole than the isotherm + 10° of the hottest month, which crosses the southern extremity of South America. Passing from the equator to the pole, before reaching the boundary between *C* and *D*, the tundra is met, so that the austral hemisphere contains none of zone *D*, zone *C* forming almost the last conti-

mental climatic district towards the south. The tundra climate is represented very little. At Cape Horn the average temperature of the hottest month is below 10° (9.1°), and that of the coldest month above -2° (-0.1° in July), so that, with the rising of the average temperature of the hottest month to above 10° one passes immediately from the tundra to climate C.

The other sub-divisions of the megathermal, mesothermal, and microthermal zones are based on the quantity and distribution of the precipitation.

Megathermal zone. — As a result of the uniformity of the temperature, the effect of the rain is always the same, whatever the season or the period at which it falls. There are two climates — that of the continually wet tropical forests, and that of the savannas, with a more or less long period of drought, which is never sufficiently long to prevent arborescent vegetation.

Mesothermal zone. — In this zone, the equatorial boundary of which is fixed by the average temperature $+ 18^{\circ}$ in the hottest month and the polar boundary by the average temperature $- 2^{\circ}$ in the coldest month, there are three climatic groups. These depend on the presence or absence of a dry period, and whether this period occurs in the hot or cold season. They are :—

1) Hygro-mesothermal, or temperate wet climate, with no well-marked dry period, designated by the symbol *Cf*.

2) Temperate warm climate, with a dry period in winter, designated by the symbol *Cw*.

The boundary between *Cf* and *Cw*, which is the month of the warm season with the maximum rainfall, has a total precipitation ten times greater than that of the driest month of the cold season. As this contrast decreases the *Cf* climate is approached more and more.

3) Temperate warm climate with a dry period in summer, designated by the symbol *Cs*. This is the characteristic climate of the Mediterranean shores, and is also found, to a lesser extent, in other districts of the boreal and austral hemispheres :— California, coast of Chili between 31° and 38° of south latitude, south-western corner of Cape Colony, and some provinces of Australia.

The boundary between *Cs* and *Cf* is the driest summer month in which the total rainfall does not exceed $\frac{1}{3}$ of the precipitation of the wettest month of the cold season.

Microthermal zone. — There are two types of climate : — 1) with a wet winter (southern Europe and western Siberia ; 2) with a dry winter (eastern Siberia, Transbaikhalia, and Manchouria).

DETAILED CLASSIFICATION AND FORMULAE OF THE VARIOUS TYPES OF CLIMATE. — In addition to the eleven principal types, the author makes a detailed study of the secondary, or transitional types, and sub-types, and shows how to deduce the formula of each by the use of the following alphabetical list of the symbols and their meanings :—

- A* = Tropical wet climates ; average monthly temperature never below 18° .
B = Arid climates.
C = Temperate climates ; average temperature of the coldest month between 18° and -2° .
D = Wet climates with cold winters; average temperature of the coldest month below -2° , that of the warmest month above 10° .
E = Tundra climates, average temperature of the coldest month between 0° and 10° .
F = Eternal snow climates ; average temperature of the warmest month below 0° .
H = High mountain climates (above an altitude of 9 800 ft).
S = Steppe climate.
W = Desert climate.
a = Average temperature of the hottest month above 22° .
b = " " " " " below 22° ; more than four months with an average temperature above 10° .
c = Less than four months with an average temperature above 10° ; average temperature of the coldest month above -36° .
d = As in *c*, but average temperature of the coldest month below -36° .
f = Constant humidity (sufficient rain or snow each month).
g = Annual variation in temperature as on the Ganges, with maximum before the summer solstice and the rainy summer season.
h = Very hot climate ; average annual temperature above 28° .
i = Uniform temperature ; annual variation less than 5° .
k = Cold winter climate ; average annual temperature below 18° ; average temperature of the hottest month above 18° .
k' = As in *k*, but average temperature of the hottest month above 18° .
m = Monsoon rains ; climate favourable to tropical forests in spite of a dry period.
n = Frequent mists.
n' = Rare mists, but much moisture in the air in spite of the lack of rain, and relatively low temperature (that of summer below 24°).
p = As in *n'*, but average summer temperature above 28° .
p' = As in *n'*, but average summer temperature between 24° and 28° .
s = Dry period in summer. } in each hemisphere.
w = Dry period in winter }
s' and *w'* = As in *s* and *w*, but with a rainy period towards autumn.
s'' and *w''* = As in *s* and *w*, but with two rainy periods separated by a dry period.
u = Thermal conditions as in the Sudan, with the coolest month after the summer solstice.
v = Thermal conditions as at Cape Verde, with hottest period in autumn.
x = Transition climate, with maximum rainfall at the beginning of summer and autumn, and dry period at the end of summer.
x' = Transition climate, with maximum rainfall after the summer solstice, and dry period in the second half of spring.
x'' = Transition climate, with rare, but heavy, rain at all seasons.

Precipitation.

Af = At least 6 cm. during the dryest month.

Aw and *As* = At least 6, 4, 2, or 0 cm. during the dryest month, according to whether the total annual precipitation is 100, 150, 200, or 250 cm. respectively.

BW and *BS* = Between the total annual precipitation (*N*) and the average annual temperature (*t*), the following ratios exist:—

$$t = 25^{\circ}..... 20^{\circ}..... 15^{\circ}..... 10^{\circ}..... 5^{\circ}..... 0^{\circ}..... - 5^{\circ}.$$

BW = $N < (t + 10)$ or $N < 35$ cm. 30 cm. 25 cm. 20 cm. 15 cm. 10 cm. 5 cm.

BS = $N < (2t + 20)$ or $N < 70$ cm. 60 cm. 50 cm. 40 cm. 30 cm. 20 cm. 10 cm.

A, *B*, *D* = $N > (2t + 20)$.

CS = During the wettest month of the cold season at least three times more rain falls than during the dryest month of the warm season.

Cw and *Dw* = During the wettest month of the warm season at least ten times more rain falls than during the dryest month of the cold season.

Cf and *Df* = Smaller differences between the precipitations of the different months.

By grouping together in different ways the symbols adopted it is possible to represent any kind of climate by a simple formula.

SECONDARY OR TRANSITION TYPES. — Mention may be made of:—

1) *High mountain climates with uniform temperatures*, in which the annual maximum variation in temperature is below 5° ; designated by the addition of the symbol *i* to the formula.

2) *Tropical forest climates*. — In spite of a dry period, the rainfall is so abundant all the rest of the year that the reserves of water accumulated in the soil suffice for the requirements of arborescent vegetation during the dry period. Thus, on the coast of Malabar, where the total annual precipitation exceeds 200 cm., tropical forests grow even when the dry period lasts four months. This type of transition to the savanna climate is included in the zone *A*, and receives the distinctive letter *m*: — *Am*.

3) *Very wet low-lying atmosphere along the coast of desert districts*. — These are opposed to the dry air of the continental deserts and of the steppes. There may be two different cases:— *a*) inland seas in desert districts; along their shores the air is warm, moist, oppressive and unhealthy; formula = *Bp* (Red Sea, Persian Gulf, Gulf of California); similar conditions, but slightly attenuated, are found in the coastal district from Gabes to Alexandria; formula = *Bp'*. — *b*). In districts away from the equator, and, consequently, cooler than the previous ones (average annual temperature 12 to 20°), but similar to them, the water vapour condenses into mist, especially during the cold season; this is the case in Peru, southern Chili, and the coast of former German West Africa, and is expressed by the symbol *Bm*. Similar conditions, but with less abundant mist, are found in certain parts of the south coast of California, the south of

the Atlantic coast of Morocco, and on the south-east coast of Somaliland ; they have the formula Bn' , the letters n and n' being used to express this type of misty desert land.

4) *Climates transitional to that of the steppes* (expressed by the letters x , x' , x''). These occur near the 40th parallel (45th in Europe, 39th in North America, 37th in Australia, and 34th in South Africa), where the steppe climate comes into contact with the wet temperature climate Cf or the Mediterranean climate Cs . They are distinguished by maximum precipitation at the end of spring or beginning of summer, and in autumn, the second half of summer being dry and clear (plain of the Po, Italy ; Castille, Spain ; central France ; Croatia ; Hungarian and Rumanian plains ; Victoria State, Australia ; much of the interior of the United States). The distribution of rain in the prairies is very similar to that in the steppes of southern Russia, and the abundant precipitation during spring and summer are of great agricultural importance. Symbol = x .

In Mexico there is a large stretch of land with a transition climate similar to that of the steppes, but the maximum precipitation occurs after the summer solstice, and there is a dry period in the second half of spring. Symbol = x' .

In the austral hemisphere the temperate wet climate Cf is represented but little ; it occurs chiefly in Uruguay and the "pampas" district of La Plata. The rain, though abundant, is irregularly distributed in the form of showers which do not penetrate the soil in such a way as to assure reserves of water, but is rapidly lost by running over the surface. The steppe-like appearance of this treeless district is certainly due, not only to the winds, but also to the unfavourable distribution of the rainfall, expressed by the formula x'' . These x , x' , and x'' transition types are included in the Cf zone.

The following table shows the chief formulae of the eleven principal types of climate, the transition types, and sub-types :—

	Principal types	Transition types	Sub types
1	$1f$	Am	
2	Aw	As	$\left\{ \begin{array}{l} s, s', s'' \\ w, w', w'' \end{array} \right.$
3	$B S$	$\left\{ \begin{array}{l} Bn, Bn', Bp \\ — \\ CX, Cwt, Cfi \end{array} \right.$	$\left\{ \begin{array}{l} h, k, k' \\ a, b \\ a, b (g) \end{array} \right.$
4	$B W$		
5	Cs		
6	Cu	$\left\{ \begin{array}{l} — \\ — \\ — \end{array} \right.$	$\left\{ \begin{array}{l} a, b \\ a, b (g) \\ a, b, c \end{array} \right.$
7	Cf		
8	Du		
9	Df		
10	E	Et, EH	
11	F	Ft, FH	

As it is not possible to reproduce the map, a list of the various climates, represented by their formulae, together with the localities or districts in which they are found, is given below : —

- 1 { A/w = Cameroons, Seychelles, Batavia, Simsonhafen.
 A/w' = Mauritius, S. E. of the Island of Celebes, New Hebrides, Porto Rico, Para.
 A/w'' = Dar-es-Salaam, Colombo, N. of the Island of Celebes, Greytown, Jamaica. Iquitos.
 A/s = Amboina, Finschhafen, Pernambuco.
 A/s' = E. of Ceylon.
 Amw = Bombay, Akyab — Amw' = Aparri (Philippines) — Amw'' = Tenasserim.
- 2 { Aw = Senegal, Mozambique, Calcutta, Manila, Vera Cruz, Cuyabá etc.
 Aw' = Madras, New Caledonia, Matamoros, Guayaquil, Ceara.
 Aw'' = Bangkok, Guatemala, Panama, Port au Prince.
 $BShw$ = Timbuctu, Khartoum, Karachi, Alice Springs, San Luis (Argentina), etc.
- 3 { Shs = Gabès, Baku, Tulare (California), Calvinia, Port Augusta.
 BSk = Odessa, Barnaul, Denver (Colorado, U S A) BSk' = Chubut.
- 4 { Bn = Swakopmund, Iquique Bn' = Agadir — Bp = Mas-saoua, Buschir Bp' = Alexandria (Egypt).
 $BIWh$ = Cairo, Strangways (Australia), San Juan (Argentina), etc.
 $BIWk$ = Astrakan, El Paso (Texas, U. S. A.), Limay (Argentina,) etc.
 $BIWk'$ = Santa Cruz (Patagonia).
 Cwa = Delhi, Hong Kong, Gondar, Mexico, Halls Creek (Australia).
- 5 { Cwa = Tsingtau, Kimberley, Mackay (Australia), Tatuhy (Brazil).
 Cwb = Pietermaritzburg, Nova Friburgo (Brazil)
 Cwi = Addis Ababa, Quito, etc
- 6 { Csa = Naples, Smyrna, Sacramento, Adelaide.
 Csb = Oporto, San Francisco, The Cape, Valparaiso.
 Cja = Nagasaki, New Orleans, Brisbane — Cja'' = Buenos Aires.
- 7 { Cjb = Hamburg, Melbourne, Auckland, Valdivia, Curitiba.
 Cfa = Milan, Budapest, Bucarest, Saint Louis, Port Elisabeth.
 Cn = Chinmax (Guatemala), Cinchona Plant (Jamaica) Bogota.
- 8 { Dla = Omaka, Cleveland
 Dfb = Riga, Sitka, Montreal
 Dfc = Haparanda, Tobolsk, Yukon, Fort York.
- 9 { Dwa = Pekin — Dwb = Blagowetchensk — Dwc = Nertchinsk.
 Dwd = Yakoutsk.
- 10 { E = Nova Zembla, Kerguelen, Cape Horn, etc.
 EH = Sautis, Pikes Peak, Mount Washington.
 EHh = Kamerunpik, Antisana.

II	{	F = Mac Murdo Sund, Snow Hill, etc.
		FH^* = Mont Blanc, Gaurinsankar, Mount Elias, Orizaba, Aconcagua
		FH_1^* = Klimandjaro, Chimborazo.
		(*) Calculated.

The author also studies the schematic representation of the distribution of climates over the world, prehistoric climates, relation between climate and soil, and influence of climate on civilisation.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

560 - Observations on Dry Farming in Italy. — JOVINO S., in *Le Stazioni sperimentali d'agricoltura*, Vol. LII Pt. 12, pp. 69-121. Modena, 1919.

I. — CLIMATE OF THE MOST ARID REGIONS OF ITALY. — According to WIDISOE's classification (1), the Girgenti district, in the south of Sicily, has a higher annual rainfall (512 mm) than 55 % of the land area of the terrestrial globe and should be classed among the sub-humid soils. But the rainfall, in spite of its importance, is not the only factor controlling climatic aridity; with it should be associated the thermal factor, which completes the idea of aridity and makes it possible to distinguish 4 different types of climate: - warm-dry and cold-dry, warm-humid and cold-humid, the first of which has a much more accentuated character of aridity than the second or third.

In Italy, the most arid soils (sometimes owing to the lack of rain and the burning heat of the summers) are found in the provinces of Taranto, Gigenti, Cagliari and Foggia, occupying the plains of Metaponto, Terranova, Campidano, and the Tavoliere in Apulia respectively. The latter is distinguished from the others, less by its lowest annual udometric average (473 mm) and by its higher summer temperatures (average and maxima), than by the nature of its climate, not marine as the 3 first, but continental, so that "*sulla*" (*Ileaysarum coronarium*) does not grow wild and *Citrus* spp. and the carob-tree do not prosper there. These recent observations confirm the classic opinion, according to which the *situculosa* Apulia was considered the most arid territory in Italy, and show the climate of the Tavoliere resembles that of Tripolitania on the one hand and that of the "Far-west" in America on the other.

In fact, the climate of the Apulian Tavoliere is characterised by the following data: —

Temperature: Absolute minimum, -7.5°C ; absolute maximum $+43^{\circ}\text{C}$.

Maximum monthly oscillations between 25.4° in winter and 34.8° in summer.

(1) WIDISOE in his work entitled *Dry Farming*, divides dry land into 4 types:—

Arid soil, receiving less than 254 mm of rain per year and occupying 25 % of the land area of the globe

Semi-arid soils receiving 254-508 mm of rain per year and occupying 30 % of the land area of the globe

Sub-humid soils receiving 508-762 mm of rain per year and occupying 10 % of the land area of the globe

Humid soils, receiving 762-4064 mm of rain per year and occupying 35 % of the land area of the globe

Mean daily oscillations between 6.4° in winter and 11.6° in summer.

Relative humidity of the air : little, varying between 37 and 61 %.

Clearness of sky : very great.

Rain : varies much according to the year, even during the course of any given month ; generally more abundant in autumn ; spring never dry, in contrast to summer and occasionally to winter.

In the Tavoliere, the distribution of the rain resembles that known as the " Pacific North-American " (to the west of the Rocky Mountains), but, while the dry-farming in the U. S. A. is carried out under cold-arid climates, the Italian form is worked in regions having a warm-arid climate; besides, it is also different from the classical dry farming of Central Europe (where more than a metre of rain falls annually) and Upper Italy.

To obtain an idea of Italian dry-farming, it suffices to study it in the great " appulo-lucana " (Apulia-Lucania) zone of plains, of an area of 700 000 to 800 000 hectares, for it includes : - 1) the most arid territories of Italy ; 2) the two types of climate — continental and marine ; 3) the greatest cereal-growing regions with extensive culture in Italy, where is found the system characteristic of extensive Mediterranean dry-farming known as " del maggese " (of the fallow).

II. - SOIL OF THE MOST ARID REGIONS OF ITALY. — The characteristic of the soil of regions with a dry climate is, according to HILGARD, the fact that the weathering of the rocks hardly goes beyond the *physical* stage, that is, their chemical composition is little modified, so that the resulting sand is less *silicious* than *silicated* and does not form (as is usually the case in humid regions) poor soils, but rather rich ones. In fact these sandy soils are simply the primitive rock in a pulverised state, slightly lixiviated by water and, consequently, having lost very little of its soluble fertilising constituents, in contrast to clay soils, of hydrolytic formation, in humid regions. As a proof of this fact, HILGARD has shown that, in the United States, the solubility of the soil in hydrochloric acid increases very much with the aridity of the climate. At the same time the average coefficients of " microsolubility " (or infinitesimal solubility) in water also increase, so that an arid climate appears to be that which best accumulates and conserves the fertility of the soil. Under an arid climate, the fertility of sandy soils is the sum of three fertilities : chemical, physical, and biological, added to by the good aeration.

In the " appulo-lucana " zone of plains the rocks that have given rise to the agricultural soils are : - 1) the subappennine pliocene clay ; 2) the water-bearing yellow sands ; 3) the volcanic rocks of the Vulture (which have furnished augite, abundant in these soils) ; 4) the abundant compact secondary limestones and the pliocene calcareous tufas forming the ranges of Gargano and Murge.

In all the calcareous formations of Apulia (nearly always covered with " terra rossa " [red soil]), " carsic " erosion frequently occurs, owing to which the rain water rapidly disappears in the sub-soil, thus making it difficult to make use of the surface irrigation usually carried out on soils with a compact calcareous sub-soil.

The lateritic "terra rossa" occurs either as cement in conglomerates of limestone pebbles, or alone (the "matine" of the Metaponto region and the "bolo" of the Lecce region), when it forms a very degraded and sterile soil, with a good texture in winter, but very hard to work in summer.

Generally speaking, in Apulian soils, rich materials (subappennine clay, sand from volcanic eruptions and particularly silicated sands) predominate over poor materials (silicious sands and lateritic "terra rossa"), as is shown by the analyses quoted by the author and by the heavy crops of cereals (30 quintals and more to the hectare) that he has observed in several localities.

The arid soils of Southern Italy tend to give up large quantities of soluble salts to water, an aptitude favoured by the presence of lime; but this fact should not be taken as indicating a relatively rapid diminution of the fertility, as the dissolved matter can be largely found there still, in the solutions circulating in the soil. On the contrary, what is lacking in the southern soils that have been long cultivated is a reserve of humus and rapidly assimilable phosphoric acid.

The saline and alkaline soils are not very extensive, but simply form small areas scattered here and there. What appears more frequent in many regions, especially in the lower Tavoliere, is the richness of the sub-soil in "macrosoluble" salts (soluble in appreciable quantities) of marine or continental origin; but, in order to prevent this subterranean salinity from harming the crops, even in summer, it is sufficient to prevent the saline solution from rising through capillary action by summer cultivation ("arrusso", etc.).

Under arid climates, the porous, aerated soils, permeable to rain-water down to great depths (which allows of sowing "in corio", i. e., on unworked ground, very much practised in Southern Italy) is little different from the sub-soil as regards its mineralogical and chemical nature, as in the case in humid climates, where the sub-soil is often more clayey than the soil. On the contrary, instead of a clay sub-soil an impermeable calcareous crust (called "carapace" in France and "hardpan" in North America) is often formed, the presence of which makes surface irrigation difficult or even injurious. In Apulia, this crust (called "crosta" in Italian) is generally not more than 50 or 60 cm. in depth.

The geological structure of the Tavoliere is very simple:— it consists of marine quaternary deposits arranged in horizontal layers; under the vegetable soil there is often a crust first, covering about 30 metres of a complex including alternate layers of clay, sandy clay, conglomerates, intercalated between layers of sand that is often water-bearing; under this quaternary complex are blue and grey pliocene clays, with frequent intercalations of water-bearing layers.

The farmers of Capitanata distinguish 8 types of soil:—

1) "*Terre ischie*": or calcareous-clay soils formed by recent alluvia, especially at the expense of the pliocene marls; subject to splitting in summer; producing hard wheats for which the winter rains suffice,

while those of spring may, if abundant, cause it to be laid and suffer disastrous attacks of rust.

2) "*Terre rosse*" (red): lying mostly on conglomerates, poor.

3) "*Terre ferrigne*": containing ferric laterite mixed with a lot of fine silicated sand (loam) and very small quantities of clay and lime; easy-working when they are humid, but very hard when dry; fertile and sought after for growing vines, tobacco and other potassiferous plants.

4) "*Raditi*": soils common in the Foggia region; grey in colour deep and profiting much from the spring rains; hardening greatly in summer, but without cracking; contain lime and often remains of "hardpan"; their tendency to form a surface crust, even in winter, makes it necessary to sow wheat very thinly; this crop suffers much from frosts, but little from rust, does not tiller much, ripens early and produces wheat of the best quality.

5) "*Terre crostose*": having hardpan at a slight depth and sometimes even on the surface, they only give a crop if it rains in spring; most of them are not cultivated, but used as pasture, with or without shrubs or trees; these do very well and might be cultivated; irrigation cannot be carried out on these soils.

6) "*Sugliani*": dark-colored, deep soils with a good texture, containing much fine sand, little organic matter and still less lime; are amongst the most fertile soils; their luxuriant vegetation hardly suffers at all from frosts or rust.

7) "*Terre focaleone*": dark-coloured, sandy soils, poor in lime and organic matter, of finer texture and more sensitive to drought than the "sugliani" and fertile owing to their richness in volcanic products.

8) "*Areniti*": soils common on the coast, formed by silicious marine sands containing 10-20 % of lime and generally less than 1 % of soluble salts, amongst which sodium chloride predominates; very "greedy" for organic matter; excellent tubers, roots and vegetables, which grow to huge sizes in them, on the contrary to what is generally observed in dry sandy soils.

III. — BIOLOGICAL CHARACTERISTICS OF ITALIAN DRY-FARMING. ---

In elaborating their dry matter, plants are obliged to consume much more water in arid climates than in humid ones (in the U. S. A., it is reckoned than 750 kg. of water is transpired per kg. of dry matter in the first case, against 400 kg. in the second) But, very fortunately, arid soils have certain factors that tend to limit this consumption of water: thus, it diminishes greatly with the concentration of the salt solutions circulating in the soil, and also with the presence of lime in it, which shows how important liming and other improvements using lime are for arid soils.

In addition, the plants themselves help to decrease transpiration by taking on a *xerophytic* (adapted to dry conditions) and *halophytic* (adapted to salinity) habit of growth, owing to which their size is diminished toward a *sub-dwarf* condition. This is why, in Sicily and Sardinia, the native varieties of wheat are shorter than the native varieties of continental Southern

Italy, and why their ripe ears are abundantly furnished with a red or even-black pigment (as with the Sicilian variety known as "scorzonera").

Arborescent crops predominate in Italian dry-farming and give it its characteristic aspect, the crops being chiefly vines and olives, which are most suited to the special conditions, followed by almonds and figs. In fact, the vine tolerates 2 % of salinity in the soil, the olive 1.8 %, the almond and fig 1.2 %, whilst the mulberry does not tolerate more than 0.2 %; in the southern coastal zones, the salinity may reach 1 %.

In these arid soils of the south, the vine does best; thanks to the aeration and lack of humus its tissues lignify rapidly, while its roots suberise easily, so that it can resist phylloxera, especially when the lack of lime leaves the acidity of its root sap unchanged; amongst the most resistant varieties is that known as "turchesca" (most liked and grown, in Apulia, for table grapes), followed by "prunesta" and "somarello".

The mulberry, however, is unsuited to arid soils, because it has to produce leaves, not fruit, and is still less suited to saline soils (see above). Neither are the Pomaceae successful; their fruit, though very scented, is often leathery.

Amongst forage plants, the leguminosae are most suited to arid soils, both on account of their deep tap-root, their capacity for assimilating atmospheric nitrogen and by the high acidity of their root sap, owing to which they can enrich the ascending sap more than other plants. In fact, the number of wild species of Leguminosae in Italy increases from the north to the south. In the south the most important are:— the lucernes, which do well in soils poor in clay and lime, especially *Medicago falcata* (with yellow flowers) and *M. varia* (with flowers varying from yellow to blue) "sulla" (*Hedysarum coronarium*), which likes clay or marl soils in a maritime climate, owing to which it is not present on the Tavoliere with its continental climate, being replaced by *Hedysarum spinosissimum* ("sulla caprina" or "sevo pecorino"). A defect of sulla hay is its coarseness; to decrease it, two cuts should be taken, one in winter, which is given green or as silage to stalled cattle, and one in May, which gives a tender hay of better feeding value than clover; by this means, the crop is increased by 25 %. Another leguminous plant of importance in the south is beans for seed, but it is being less and less grown, and the author says that it would be better to replace it by forage leguminosae. From experiments made in a demonstration field near the Vulture, the author has concluded that:— 1) a leguminous meadow suffers less from drought than leguminosae grown for seed; 2) in very dry years, chemical manures are harmful directly to leguminosae grown for seed and indirectly to the wheat following after; 3) in a dry year, exuberant vegetation in winter and spring is very injurious to the production of seed.

As regards cereals, the hardness of the grain increases from north to south, from the sea to the continent; it generally depends on a higher content of organic nitrogen and of gluten, which in turn depends on a greater supply of heat and light. Prof. Giglioli is, therefore, right in the opinion he has long held that the arid South furnishes the best seed grain in Italy.

561 - The Hygroscopicity and Hydrological Importance of Moss. -- PICCOLI, L. in *Le Scienze sperimentali agricole italiane*, Vol. L1, Pt. 7-8, pp. 312-315. Modena, 1915.

It has been observed that the mossy covering of wooded land, besides fertilising the soil slightly, also protects it from sudden changes of temperature, decreases evaporation and, acting like a sponge, holds a large amount of water, thus preventing the surface layer from being washed away, especially on rocky slopes.

As direct experiments on this subject were lacking in Italy, the author has made some, determining the capacity for soaking up water of thick carpets of moss in the natural state. As soon as gathered, the tufts of moss were soaked in a bath of water for half an hour, then left to drain for another half hour until they parted with no more water, then weighed; they were next dried in the sun in a well-ventilated place until the volume of water was reduced to 12-15 %, then weighed again. The results, given in the appended table, show that a square kilometre of steeply sloping land covered with moss, holds and conserves for the woods, streams and the atmosphere, from 1 000 to 3 000 cubic metres of water which would otherwise drain into the valley to swell the torrents and rivers at times of high water.

Species	Weight, in gm. of 1 sq. metre of moss		Quantity (in gm. or cm.) of water retained by 1 sq. m. of moss	Number of times the moss has retained its own weight in water
	drained in the air	soaked with water		
<i>Antitrichia curtipendula</i>	351	2 229	1 878	5.85
<i>Dicranum scoparium</i>	247	2 107	1 860	7.53
<i>Homalothecium sericum</i>	117	1 167	1 050	8.97
<i>Hylacomium splendens</i>	437	2 770	2 333	5.33
<i>H. triquetrum</i>	757	3 567	2 810	3.71
<i>Hypnum molluscum</i>	392	3 152	2 760	7.04
<i>Isoetecium myurum</i>	358	3 007	2 649	7.39
<i>Leucodon sciuroides</i>	123	981	858	6.97
<i>Mnium undulatum</i>	678	3 562	2 884	4.25
<i>Thuidium tamariscinum</i>	283	2 482	2 199	7.77

562 - Soil Acidity as Affected by Moisture Conditions of the Soil - CONNOR, S. D., in the *Journal of Agricultural Research*, Vol. XV, No. 6, pp. 321-329 + Bibliography of 7 Publications. Washington, November 11, 1918.

It has previously been shown that drained soil is less acid than un-drained soil. To throw more light on this subject the author studied five typical Indiana soils under controlled moisture conditions. The soils studied were: — 1) a yellow silty clay; 2) a whitish silt loam; 3) a brown silt loam; 4) a black peaty sand; 5) a dark brown peat. The experiments lasted one year and were made with pots. At the end the acidity was found to vary with the different moisture contents. Soils rich in organic matter were most acid when completely saturated, whereas soils poor in organic matter were most acid when half saturated. Potassium nitrate extracts

of fully saturated soils contained more iron in the ferrous forms than less saturated soils.

Fully saturated mineral soils had a higher content in soluble manganese but a lower content in soluble aluminium than other soils.

The measurable acidity of acid soils depends largely on the different conditions of moisture and aeration. The variations are due to chemical rather than physical changes in the soil.

The acidity of damp soils is due to leaching of the strong bases, removal of the bases in crops, the decay of carbonaceous and nitrogenous substances, and the hydrolysis of the mineral compounds and organic matter.

563 - The Solubility of the Soil Potash in various Salt Solutions — TREISSER, F. K. in *Soil Science*, Vol. VI, No. 3, pp. 237-257 + Bibliography of 29 Publications Baltimore, September 1918

Text books contain much contradictory and unreliable information on the power of sodium, calcium, and magnesium to replace potassium in soil and to make it available for plants (1). The author made a series of experiments on the liberation of potash from the soil by salt solutions in different types of loam, sandy loam, silt loam and humus loam soils.

He found that calcium sulphate increases the solubility of potash in some soils. This action is much more marked on sandy parts of the soil, and explains why only some soils benefit by the application of gypsum. Bi-calcium phosphate and tri-calcium phosphate have very little effect on the solubility of potash in soil, and mono-calcium phosphate seems even to decrease this solubility. It would appear, therefore, that any effect super-phosphate has in making soluble the potash in soil is due to the calcium sulphate it contains.

Carbon dioxide and calcium carbonate solutions increase the solubility of potash in silt loam. Sodium salts are sufficiently active to dissolve potash in soils, and the action of sodium chloride increases with its concentration in the soil solution. The fact that beets require sodium for complete growth may explain the beneficial action of salt on certain crops.

564 - Soil Factors Affecting the Toxicity of Alkali. — HARRIS, T. S. and PITTMAN, D. W., in the *Journal of Agricultural Research*, Vol. X¹, No. 5, pp. 287-319 + 27 Figs. Washington, November 1, 1918

The aim of the investigations described was to determine as exactly as possible the quantity of the various salts necessary to crops in arid soils. Over 12 000 determinations were made of the effect of alkali salts on the germination and growth of wheat under varying conditions.

In sand cultures the size of the particles does not influence the toxicity of the alkali. Loam soils tolerate alkali better than sand or clay. When the coarseness of the loam varies, moisture is an important factor with regard to the tolerance of alkali as is seen by the behaviour of the plants.

(1) See *R. F. C. B.*, 1919, No. 157 (*F. d.*)

Organic matter increases the resistance of plants to alkalis when the soil contains sufficient moisture but if the content in organic matter is high and the moisture supply low, the power of resistance decreases. In general the resistance to alkalinity increases with the moisture content up to the maximum for a good crop.

The toxicity of sodium chloride and sulphate seems to depend to a certain extent on the relation between the salt concentration and the percentage of moisture, but the toxicity of sodium carbonate is largely influenced by the presence of organic matter which removes large quantities of sodium carbonate from the soil solution.

CONCLUSIONS. — 1) Loam soils and soils with a high water-holding capacity may be successfully cultivated even though their alkali content is in excess of that of other soils.

2) Soils in which alkali decreases the yields should be kept as moist as is compatible with good plant growth.

3) Manure, or other organic matter, may prove beneficial to alkaline soils, especially those rich in carbonates.

565 - **Reaction of Hawaiian Soils with Calcium Bicarbonate Solutions its Relation to the Determination of Lime Requirements of Soils and a Rapid Approximate Method for the Determination of Lime Requirements of Soils.** — JOHNSON, M. O., in the *Journal of Industrial and Engineering Chemistry* Vol. X No. 1, pp. 31-33 + 1 Fig. Eastern Pt. January 1918

The importance of liming for maintaining the fertility of the soil is so generally recognised that many methods for determining the lime requirement of the soil are in existence. Most of these methods are, however, based on reactions which do not correspond to conditions in the field. When lime is applied to the soil in the anhydrous (CaO), hydrate ($\text{CaO} \cdot \text{H}_2\text{O}$), or carbonate (CaCO_3) form, the principal reaction of the fertilised soil appears to be with a calcium bi-carbonate solution. The absorption of calcium bi-carbonate solutions by soil increases with the duration of contact and tends to a state of equilibrium. In proportion as the concentration of the calcium bi-carbonate solution decreases, however, the total absorption decreases, whereas an increase in the absorption percentage of the calcium bi-carbonate would show that at a given concentration, absorption would be complete as a result of prolonged contact with the soil. The total quantity of calcium carbonate, expressed in percentage of the weight of the soil, in a solution whose degree of concentration marks the point of complete absorption by a given soil, represents for this soil a definite absorbant power which the author calls the "absorption minimum".

The author proposes the following method for determining the lime requirement of the soils in Hawaii — 200 cc. of an $\text{N}/100$ solution of calcium bi-carbonate are poured into a 500 cc. Erlenmeyer flask and 10 gm. of the soil to be examined added. The flask is well shaken for 10 seconds and the contents poured on to a filter, 100 cc. of the filtrate are then titrated with $\text{N}/10$ nitric acid using methyl orange as an indicator. The difference between the titration of 100 cc. of filtrate and an equal volume of the original

solution is proportionate to the calcium carbonate required by the soil. By multiplying this amount by 10 the number of tons of calcium carbonate required by 2 000 000 lb or 1 acre of soil is obtained. A difference of 0.1 cc. of $\frac{N}{10}$ nitric acid in the titration is equal to an absorption of 0.01 % of calcium carbonate by 10 gm. of soil.

- 566 - **An Accurate Loss-on-Ignition Method for the Determination of Organic Matter in Soils** -- RAUBER, J V, in *The Journal of Agricultural and Engineering Chemistry*, Vol X No 6 pp 439 442 + 1 Table + 3 Figs Easton, Pa, June, 1918

The inexactitude of the results obtained with the usual method of ignition used to estimate the organic matter of soils is due to the presence of hydrated, carbonated and unoxidised, minerals. To eliminate this source of error the author proposes to digest first the samples of soil in the warm in a nuxture of dilute hydrochloric and hydrofluoric acids which only dissolves a minimum amount of organic matter. The soil is then ignited. This method gives more exact results than the usual simple method of burning and even than the determination of the organic carbon by the difference between the total carbon and inorganic carbon

- 567 - **Determining the Absolute Salt Content of Soils by Means of the Freezing-Point Method.** -- BOUYOCOS G I and MACCOOL, M M, in the *Journal of Agricultural Research* Vol XV No 6 pp 331 336 Washington November 11, 1918

The determination of the concentration of a soil solution by measuring the freezing point directly in the soil mass (1) is an excellent method of determining the absolute salt content of soils. It was found that, with a relatively high moisture content, the effect of unfree water on the salt concentration of the soil is negligible in practice. The following method is, therefore proposed for a comparative study of the absolute salt content of different kinds of soil - 15 gm of air-dried soil are put into a freezing tube containing 10 cc of distilled water, and the freezing point determined by the usual method. By the freezing point depression it is easy to calculate the salt content of soil in parts per million (2). When the soils are light, it is best to use 20 gm per 10 cc. of water, and, when they are alkaline, 1 gm per 5 cc of water.

Previously it was only possible to determine the concentration of soil solutions under varying moisture conditions; by this modified method the absolute salt content of different soils may be determined and these salt contents accurately compared

- 568 - **On a Very Delicate Reaction of Copper Applicable to the Analysis of Ash and Arable Soils.** -- MAQUINNE F and DEMOUSSEY T, in the *Comptes Rendus de l'Académie des Sciences* V 165 N 10 pp 439 442 Paris March 1911

A sufficiently concentrated solution of ash in hydrochloric acid, freed from iron and manganese, and treated with potassium ferrocyanide,

(1) BOUYOCOS and MACCOOL method, *Soil Sci Soc* 1919 No 15 § III (11)

(2) A depression of 0.001 C is considered equal to 100 millionths. See BOUYOCOS, G Y Further Studies on the Freezing Point Lowering of soils, in *Michigan Agricultural Experiment Station Technical Bulletin* No 31, 1910, (Ed)

usually turns a yellowish pink, showing that copper is present. But this coloration is usually not stable ; it becomes attenuated, leaves the solution turbid and finishes as a blackish precipitate with a bluish tinge. The authors investigated the cause of this anomaly and found that it is due to the presence of zinc, which generally occurs with copper in plant organs. The precipitate only forms when the solution contains both the metals (which proves that the reaction of which it is the result can only take place between "sols" and not between "gels"). The blue coloration attains its maximum density when four or 5 times more zinc is present than copper. It is the most delicate of all the inorganic reactions that can show the presence of very small quantities of copper. The blue tint of the precipitate is still perceptible in a solution containing only 1 to 1.5 mgm. of copper per litre, but the zinc and copper must be present in suitable proportions and the solution must be quite free from nitric acid and iron. Below is given the authors' description of their method, which has the advantage of being quicker than the classic procedures and, moreover, requires only very small amounts of material : —

The ash (from 50 to 200 mgm.), calcined in a quartz crucible in the presence of a few drops of nitric acid and a slight excess of sulphuric acid (to render most of the calcium insoluble), is treated with 1.5 cc. of 5 % sulphuric acid and boiled for 20 minutes. The liquid, together with the water used to wash out the crucible, is placed in a tube, centrifugated and then electrolysed. After 12 hours, the cathode is washed with a few drops of warm nitric acid and a little water, then evaporated and calcined ; a few drops of hydrochloric acid are added and the solution is washed into a tube (2 cc. of liquid) ; 2 drops of 1.104 % zinc sulphate solution and 1 drop of 10 % potassium ferrocyanide solution are added. The colour of the precipitate can easily be compared with that of types with a known copper content ; so that the weight of copper in the solution can be ascertained approximately.

With this method the authors found quantities of copper ranging between 3 and 5 mgm. per kg. in a number of seeds (wheat, maize, peas, French beans, castor-oil, etc.). By means of this method the copper in arable land can be detected and ascertained approximately ; for the reaction only 5 gm. of matter are required.

MANURES
AND MANURING

569 — **Results of Manurial Experiments on a Peat Soil in Holland** — MULDER, A. G., M IJER, C. and HUIJDE, J., in the *Verslag van Landbouwkundige Onderzoekingen der Rykslandbouwschetsstation*, No. 22, pp. 177-179 + 1 figs. + 25 Tables. The Hague, 1914.

Results of 35 years of manurial experiments with chemical manures on a peat soil that had been cultivated for a long time, and which had been given farmyard manure in the last few years before the experiments were started. The experiments had the object of ascertaining whether the substitution for farmyard manure of chemical manures (nitrogen, phosphoric acid, potash and lime) would maintain the fertility of the soil. The crops grown were potatoes (several varieties), rye and oats.

The authors found that, in this peat soil rich in humus, the exclusive use of chemical fertilisers maintained the fertility at the same level during the 35 years of the experiments, provided that the ratio *bases : acids* was always well balanced. Farmyard manure applied alone, or together with chemical fertilisers, or alternately to them, did not show any superior fertilising value to that of chemical fertilisers used alone.

The potato, which is especially exigent as regards potash, requires little nitrogen and still less phosphatic manure. Rye has the same requirements, oats, on the contrary, have special need for nitrogen, are less exigent for potash and still less for phosphoric acid. In any case no single one of the three chief fertilising elements (nitrogen, potash, and phosphoric acid) can be excluded from the fertiliser applied to this peat soil without reducing the crop yield.

Some special observations are also given, Farmyard manure gave good results with potatoes (first year of cultivation), but the following crop (rye or oats) was not successful.

The best results were obtained with a complete fertiliser mixture containing nitrogen in the form of nitrate of soda. A fertiliser mixture without potash gave poor results — the epigeal part of the potato was undersized and had a characteristic brownish colour; with oats and rye, the grain was too small and light, while the straw was very brittle. A fertiliser dressing excluding nitrogen gave the same poor results, but the lack was less pronounced when phosphoric acid was excluded from the mixture. When the various chemical fertilisers were applied separately, the results were hardly any better, except that the crop obtained with potash alone, though lacking as regards quantity, was sometimes satisfactory as regards quality. In conclusion, in a complete mixture of fertilisers, nitrate of soda proved to be much better than sulphate of ammonia.

570 - The Fertilising Value of Activated Sludge - NASMITH G. G. and MAC KAY, J. P., in *The Journal of Industrial and Engineering Chemistry*, Vol. X, No. 5, pp. 339-344 + 7 Figs. Boston, P. I., May 1918.

The most important problem to be solved with regard to the disposal of sewage is that of the economic concentration of mud. The discovery of the so-called "activated mud" method has necessitated the devising of a method for separating this new type of residue from water, and the fertilising value of this residue makes the problem still more pressing.

By the "activated mud" method, finely divided air is blown into the sewage. After a certain lapse of time the mud which settles has valuable properties when mixed with fresh sewage by means of the same aeration method. The organic matter is rapidly oxidised, the intestinal bacteria are destroyed and nitrates formed.

The mud thus obtained contains, like other mud, 95 % of water, but the treatment of sewage water by the method in question is very promising because the fertilising value of the mud is very high and the benefit derived from it would repay the expense of separating it from the

water. A large part of the fertilising value of town waste would thus be preserved and would largely contribute to the maintenance of the supply of humus and nitrates in the soil, as well as increase its fertility and productivity.

The author mentions comparative experiments made by him on different vegetables with activated mud and ordinary manure, mud from an old deposit, humus from a brush filter, and cistern mud, all dried in the air and used on similar plots. As compared with manure, activated mud gave an increase of yield of 40 % with early radishes, 103 % with lettuce, 77 % with beans, 138 % with beets, 316 % with late radishes, 291 % with tomatoes, and 87.1 to 55.4 % with onions, but no increase with carrots. The activated mud used in the experiments contained 2.50 % of nitrogen and 2.46 % of phosphoric acid. That used by BARTOW and HATFIELD contained 6.3 % of total nitrogen and 2.69 % of phosphoric acid (1).

571 - **Investigations into the Utilisation of Raw Mineral Phosphates in the United States.** - I W. G. JAMES W., and WAGNER R. C., The Agricultural Availability of Raw Ground Phosphate Rock in *The Journal of Industrial and Engineering Chemistry*, Vol. X, No. 6, pp. 442-444. Platon, Pa. 1918. - II IDEM The Use of Mine Run Phosphates in the Manufacture of Soluble Phosphoric Acid *Ibid*, Vol. X No. 5, pp. 353-355. Easton, 1918.

I. — 'THE AVAILABILITY OF RAW GROUND PHOSPHATE ROCK' — The authors summarise the results of all the investigations into this subject made by the agricultural stations of the United States in the laboratory, greenhouse (23 experiments), and in the field (232 experiments). They come to the following conclusions:—

Taking into consideration only experiments which lasted at least five years, it is seen that the application of medium or large quantities of raw rock phosphate caused, in most of the soils tested, an increased yield in many crops during the first year. To be efficacious as a fertiliser rock phosphate must be spread evenly over the ground as a fine powder. The presence of decomposing organic matter increases the efficacy, probably because of the greater bacterial activity produced and the higher percentage of carbon dioxide given off. Fineness of the powder and the presence of organic matter together prolong the efficacy of raw phosphate rock for another year, or even more. On the other hand, as the action of superphosphate is more rapid than that of bone powder, basic slag and mineral phosphates, it is probably preferable to any other phosphatic fertiliser when the aim is to obtain rapid growth of the plants cultivated.

To obtain the best results with powdered rock phosphates they must be applied in larger quantities than superphosphate. Whether it be best to apply rock phosphates in a soluble or insoluble form to produce the most economical increase in yield depends on the nature of the soil, the cultural method, the price of the phosphates, the duration of the vegetative

(1) *The Journal of Industrial and Engineering Chemistry*, Vol. VIII, pp. 17-20, 1916. (*Ed.*)

period, and other local factors. It is a question which, to a certain extent, must be solved by each farmer individually.

II. -- THE USE OF MINE RUN PHOSPHATES IN THE MANUFACTURE OF SOLUBLE PHOSPHORIC ACID. — Rock phosphate direct from the mine may be suitably treated in the electric oven without sifting or previous washing, thus avoiding the loss of low-grade waste. Experiments made with a load of 500 lb. of mixed raw rock phosphate, coke, and sand (in the absence of silica), smelted in the electric oven for 3 hours, gave a yield of phosphoric acid corresponding to 98 % of the total phosphorus and costing much less than if high-grade phosphates had been used.

If phosphoric acid thus obtained be used to transform rock phosphate into so called "double" superphosphate, the cost of production will compare favourably with that of producing ordinary superphosphates with sulphuric acid when there is a shortage of this acid.

572 - The Fertilising Value of Vivianite and "Vesta Phosphate"; Researches in Belgium. — GRAFFIAT J and COURTOY, M. P., in the *Annales de Gembloux*, Year XXV, No. 1, pp. 19-27 + 3 Tables. Brussels, January and February 1911.

Owing to the lack of fertilising material during the war, new or little known products have been sought for in order to supplement, to a certain degree, the fertilisers that were previously used. The following new products have been put on the market:—

1) Vivianite, hydrated phosphorate of iron, found mostly in the deposits of limonite in the marshy soils of the Campine district of Belgium.

2) "Vesta phosphate", obtained by calcining a mixture of cretaceous phosphate and phonolite at high temperatures. Owing to the difficulty of obtaining phosphatic manures, these substances became of interest, but nothing certain was known as to their value as fertilisers. Previous experiments (BÖTTCHER, PETERMANN) have shown that the probable fertilising value of vivianite should be included between 22 and more than 100 % of that of superphosphate. New experiments were required to furnish a more certain idea of its value.

The authors tested the two manures with maize and forage cabbage, grown in 3 series of pots receiving "Vesta phosphate", vivianite, and superphosphate respectively and, as complementary fertilisers: -- 1) nitrogen as sulphate of ammonia; 2) potash as the sulphate; 3) calcium carbonate. From the weights of the air dried crops it was concluded that:—

1) "Vesta phosphate" is remarkably efficacious, even more so than superphosphate; taking the average yield obtained with superphosphate as 100, that obtained with "Vesta phosphate" was 120-109-123-107;

2) crude vivianite has only shown a relatively weak fertilising value, the increases in yield obtained only being 42 and 39 compared with the average given by superphosphate (100); desiccation at 110° C. decreases its fertilising value still more, for the comparative increases in yield obtained in this case fell to 30 and 34.

573 - Condition of Fertiliser Potash Residues in Silty Loam Soil in Pennsylvania U. S. A. — FREDERICK, W. and ERB, E. S., in the *Journal of Agricultural Research* Vol. XV, No. 2 pp. 59-81 + Bibliography of 9 Publications Washington, October 14, 1918

Many facts seem to show that crops never utilise all and often not half of the potassium contained in the ordinary potassic fertilisers. It is, therefore, important to know the agricultural value of the residual potassium left in soils by these fertilisers. To solve this problem the authors studied a silty loam soil part of which had received applications of 100 lb. of muriate of potash every two years for 36 years, and part no potassium fertiliser. The plots had been cultivated in the same way and had been planted to the same rotation of maize, oats, spring wheat, and a mixture of timothy and clover.

In each plot the state of the potassium was determined by extraction with concentrated hydrochloric acid, $N/5$ hydrochloric acid, distilled water, carbonated water, and ammonium chloride solution, and by estimating the potassium dissolved in the form of platinum-chloride. The fine, air-dried soil of the unfertilised plot contained 3.821 % of the total potassium.

RESULTS. — In the first extraction more potassium was dissolved from the fertilised than from the unfertilised soil. The difference, relatively slight with concentrated hydrochloric acid, was more marked with weak solvents, which extracted twice as much potassium from the fertilised as from the unfertilised soils. Of the weak solvents, $N/5$ hydrochloric acid dissolved most potash.

Much less potash was dissolved by a second extraction with weak solvents than by the first, and the quantities were practically the same for the fertilised as for the unfertilised soil.

The clay and non-clay of each soil were analysed separately. The clay contained much less potash than the non-clay but both were richer in potash in the treated than in the untreated soil.

There was little difference in the crops of the fertilised and unfertilised plots. This was probably because the soil was itself naturally rich in potash. The plants which received potassic fertiliser, however, absorbed much more potash (up to 40 % more) than the unfertilised plants.

CONCLUSION. It seems probable that much of the potassium applied in fertilisers remains at the surface in a highly available state, but most remains in a slightly available form. The losses by drainage are not great.

574 - Comparative Trials of Nitrogenous Manures in France. — BACHELIER, in the *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. V, No. 5, pp. 161-170 + 1 Table Paris, January, 1919

M. SCHLOESING recently studied the possibility of using as nitrogenous manure large quantities of ammonium nitrate made during the war for the production of explosives. He took into consideration his pot experiments (1) with forage maize from which he concluded that 1 lb. of ammonium nitrate had the same effect on vegetation as 1 lb. of nitrogen supplied by ammonium sulphate. For his tests he divided a good, homogeneous field,

(1) See *R. Aug.*, 1918, No. 847 (E1)

free from weeds, into squares of 1 are (119.60 sq. yds), separated from each other by a path 1 metre (3.28 ft.) wide. The soil had never been manured or fertilised.

To compare the effects of ammonium nitrate with those of sodium nitrate or ammonium sulphate, used separately or together, these manures were mixed with superphosphate in quantities varying with the amount of nitrogen supplied, and spread on the land on May 31, 1918. On June 1 beets were sown in the plots. After the customary hoeing the plants were harvested on December 5. In the table showing the results a comparison of the weights and densities of the roots in the plots with the nitrogenous manures and the control ones without, an increase in favour of ammonium sulphate is found. If, however, the yields obtained with sodium nitrate are compared with those obtained with ammonium nitrate, it is seen that, in one direction, the difference lies in small quantities, and in the other direction in large ones. These first tests, therefore, seem to confirm the theory that the unit of nitrogen in ammonium nitrate has the same value as in the other salts hitherto supplied commercially. When working in the field the small causes of error due to the nature of the soil, which, in spite of its homogeneousness, are always liable to occur, must be taken into consideration.

The author points out that, in the plot which had received the largest amount of sodium nitrate, « jaundice » (of bacterial origin) occurred to a very serious extent. He connects this observation with those frequently made by him with respect to the action of sodium nitrate on beets. In a soil with a clay or siliceous clay sub-soil, after a period of intense drought in August and September, beets run a grave risk of being attacked by the so-called "heart disease of beets", studied, together with "jaundice" by PRILLEUX and DELACROIX, and due to *Phoma Betae*. The damage is all the greater the larger the quantity of sodium nitrate which has been added as fertiliser. For this reason the proportion of sodium nitrate is often reduced and the quantity of ammoniacal or organic nitrogen increased. As ammonium nitrate does not produce this intense "jaundice" it seems that its use in large quantities may be recommended wherever it is unwise to use equivalent quantities of sodium nitrate. It may, therefore, be admitted that ammonium nitrate is as useful for agricultural purposes as would be expected from its composition.

575 - The Effects of Inoculation, Fertiliser Treatment and Certain Minerals on the Yield, Composition and Nodule Formation of Soybeans. — FELLERS, C. R., in *Soil Science*, Vol VI, No 2 pp, 81-119 + 5 Plates + Bibliography of 54 Publications. Baltimore, August, 1918

Inoculation has often been shown to produce good results on the yield of soybeans and their protein content, but little or nothing is known of its effect on the oil content of the seed. The author made experiments on this subject with pot cultures both in the greenhouse and in the field, using the Eyebrow variety of soybean. The results obtained showed that inoculating the seed before sowing, or the soil in which the seed are placed, with pure

or commercial cultures of *Bacterium radiculicola* or well-infected soil, gave a marked increase in yield. The protein content increased, but the oil content decreased, in direct proportion to the completeness of infection. The average decrease in oil was 3 %. The nodule bacteria of the soybean spread very slowly in the soil unless transmitted by agents such as water, wind, etc.

In acid soils the application of small quantities of lime is very important for inoculation because it greatly stimulates nodule formation. The formation of protein and oil, however, is influenced in a parallel or inverse ratio, as described above. Small applications of superphosphate were equally beneficial in increasing the oil content which added after liming. Potash was less favourable. Sodium citrate inhibited nodule formation and consequent fixation of atmospheric nitrogen. Manganese had very little effect. Sulphur was slightly injurious when applied in large quantities. Gypsum up to 600 lb. per acre had little effect, but in larger quantities it increased the oil content and stimulated nodule formation. No conclusive results were obtained with zinc sulphate or ferric sulphate.

576 - Contribution to the Study of the Flora and Fauna of Belgian Congo. — *Bulletin agricole du Congo Bel.*, Vol. IX, No. 1-4, pp. 253-398 London, March-December, 1918.

The notes on the flora are edited by M. P. MINY and Dr. VERMOESEN. They include a note on the collection of herbal material, a description of some African woods, fibres of *Maniophyton* and *Cephalonema polyandrum*, preparation of various fibres from the da Lemba Congo (Lower Congo), an interesting variety of *Elaeis* ("Basatoum" called "Klude" in the Cameroons, and "Ayara Bwana" in Nigeria), a note on the *Triumfetta* (fam. *Tiliaceae*), "roucou" or "Annato" (a dye extracted from the pulp surrounding the seed of *Bixa Orellana*, "baobab" (*Adansonia digitata*) bark.

The notes on the fauna are edited by M. E. HAGH. They include a list of the game and wild animals of the Bianos table-lands, distribution of the fruit-eating bats in Belgian Congo, collection of birds from Belgian Congo, new fresh water fish found in the Congo basin, various studies on Glossina, tsetse flies, mosquitoes, wasps, and the parasitic nematodes of Belgian Congo.

577 - On the Toxic Constituents in the Bark of *Robinia Pseudo-acacia*. — TASAKI, I., and TANAKA, U., in *The Journal of the College of Agriculture Imperial University of Tokyo* Vol. III, No. 5, pp. 337-356 + 4 Tables, Tokyo, May, 1918.

The authors isolated from the bark of *Robinia Pseudo-acacia* a new toxic glucoside which they called "robitin". The fresh bark contains 1 % of this glucoside, a white, odourless powder, slightly bitter in taste and easily soluble in water. Robitin is toxic to horses, cattle, guineapigs, and rabbits in quantities of 0.0015 gm., 0.0200 gm., 0.0700 gm., and 0.5000 gm. per kilogramme of body weight respectively. One of the principal symptoms of poisoning is paralysis of the hind part of the body.

578 - On the Absorptive Power of the Tips of Roots — COUPIN, H., in the *Comptes Rendus de l'Académie des Sciences*, Vol. 168, No. 10, pp. 519-522 + 3 Tables. Paris, March 12, 1919.

It is generally admitted that roots can only absorb liquids by their middle region, often covered by absorbent hairs, and cannot do so either

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by their bare base or by their tip. As the author was led to doubt the truth of this opinion by numerous observations, he carried out a series of researches, the results of which have substantiated his doubts. He quotes some of his results as examples and states that all his other experiments gave exactly the same results.

Two germinations of the grey pea (*Pisum arvense*), for example, each having a gemmule barely visible and a root 3 cm. long, were both placed in the same flask., one, *A*, simply suspended in the damp air, the other *B*, also suspended in the same air, but with 2 to 3 mm. of the tip of its root dipping in the water placed in the bottom of the flask, which was placed in a dark incubator kept at 24°C. After 24 hours, it was found that the root of *B* had grown much more than that of *A*; *B* was lifted every 24 hours so that its root was only in contact with the surface of the water at its tip. At the 144th hour the final result was that *A* was dead, while the root of *B* was 9 cm. long and had 20 root hairs (that of *A* was only 4 cm. long, with 3 root hairs) while its gemmule was 6 cm. long (that of *A* being hardly visible).

The author gives the results of similar experiments with *Ricinus*, the American bean and pumpkin. They agree in every way with the previous ones and show that the young plant *whose root tip alone is immersed in water* develops normally, developing its tap root a good deal and giving out a number of root hairs, while its aerial part increases notably in length; in short, develops like a plant *all* of whose root is immersed in the liquid. Owing to the behaviour of the control plant there is no need to entertain the hypothesis that the growth is due to water extracted by the plant from the damp air surrounding it or to that contained in its cotyledons or albumen.

CONCLUSIONS — 1) The root, contrary to the statements in classic works, *can absorb water through its tip*, which includes the cap (if present) and the terminal meristem, which was previously denied any absorbent power.

2) *The water thus obtained by the root suffices for it to attain the maximum development* compatible with the small quantity of food material available and with life in darkness.

579 — **Influence of the Nature of the Soil and Manuring on the Content of Nitrogen and Mineral Elements in Cultivated Plants.** — MASCHHAUPT, J. G., in the *Verslagen van Landbouwkundige Onderzoekingen der Ryksland bouwproefstations*, No. 12, pp. 25-116 + 70 Tables + 1 Fig. The Hague, 1918.

Experiments carried out for 7 years at the Royal Agricultural Experiment Station at Groningen on a heath soil, a peat soil, a marsh soil, a loamy soil, and a clay soil, using nitrate of potash, nitrate of soda and sulphate of ammonia as fertilisers. The soil of the numerous experiment plots has been analysed and the nitrogen and unorganic contents of the plants determined.

RESULTS. — *Influence of the nature of the soil.* Marsh soil, when dried and mixed with sand, is excellent for crops; of all the soils tried by the author, it was this soil that best satisfied the nitrogen requirements of the cultivated plant; it always gave the crop with the richest nitrogen content,

but, on the contrary, with the poorest phosphoric acid content, although the phosphatic manuring was the same for all the peat and heath soils.

As regards the mineral and nitrogen content of the plant the nature of the soil had most influence on the straw of cereals and the epigeal part of the beet and potato than on the seeds, root and tuber. On the other hand, this influence had more effect on the epigeal part of the beet and potato than on the straw of cereals. In this connection, great differences were observed in the contents of nitrogen, phosphoric acid, lime and potash (for the latter especially in the haulms of the potato).

The influence of the nature of the soil on the silica content of the straw of cereals was still more manifest; with a cereal grown in clay soil, this content was, on an average, 5 times greater than in a cereal grown in sandy soil. The cereals extracted much more silica from a loam or clay soil than a heath, peat, or marsh soil, but without extracting more basic elements at the same time. Plants grown in clay soil were distinguished from plants grown in loamy soil by higher nitrogen, phosphoric acid, potash and silica contents, which agrees with the composition of these soils as shown by analysis.

Influence of manuring. - Generally speaking, nitrate of potash does not appear to increase the yields as much as nitrate of soda. The nature of the nitrogenous manuring (nitrate of soda, nitrate of potash and ammonium sulphate) has little influence on the nitrogen and ash content of cultivated plants. In any case, with mangels (root and epigeal part), the application of nitrate of potash notably increased the potash content, while that of nitrate of soda considerably increased the soda content.

When comparing, for the same soil, the respective composition of plants grown a) without nitrogenous manuring, b) with nitrogenous manuring, it was generally found that, in the first case, the nitrogen, phosphoric acid, sulphuric anhydride and chlorine contents of the plants were higher, while the contents of basic elements had hardly increased at all or were even similar to those found in the second case (with nitrogenous manuring). This apparently paradoxical fact is probably a special case of the following general rule: anything that causes a decrease in yield of cultivated plants produces an increase in their content of nutritive elements, more for nitrogen and the acid elements than for the basic elements.

580 - Methods for Collecting and Registering Observations Adopted by the Selection Station of Eckendorf, Germany. - L. ANSEN, W in the *Zeitschrift für Pflanzenzüchtung*, Vol. VI, Pt. 3-4, pp. 119-138 + 12 Tables + 2 Figs. Berlin, December, 1918

PLANT
BREEDING

The numerous observations collected and registered at the Selection Station of Eckendorf, near Bielefeld, Germany, may be divided into five groups:

- I) Genealogical tree.
- II) Observations on growing plants, data on harvest; plans of the selection fields.
- III) Observations made during selection work.
- IV) Behaviour of the characters in the various strains and families.

V) Guide to working methods ; diary of work done ; meteorological observations ; germination tests.

I. — GENEALOGICAL TREE. — This makes it possible to recognise at a glance the state of the selection work and the position and origin of each strain. The strains are expressed by capital letters (*A, B, C*, etc.), to which small letters are added to distinguish the parent strains (*Aa, Ab, Ac... Ba, Bb, Bc...*). In addition each plot and each plant in it are numbered.

Let it be assumed that, in 1915, in plot No.6 of *A* a plant (cereal) No.3 be chosen and isolated, and its seed sown in 1916 on plot No.4. In the genealogical tree, beneath the letter *A*, and opposite the year 1915, a small circle will be made containing the formula $\frac{9.3}{6}$ and, below it, opposite the

year 1916, another small circle containing the formula $\frac{6.3}{4}$. If from plot No.4 of 1916 plant No. 1 be chosen and its seed sown in 1917 on plot No.7, a third circle with the formula $\frac{4.1}{7}$ will be made opposite the year 1917, and so on.

The plants grown on one plot form a family. If a family is to be propagated (without any selection) on a propagation plot, a small circle is made containing a fraction the denominator of which is the number of the plot, and the numerator the letter of the strain, followed by the year in which the seeds are taken for propagation (e. g. : — $\frac{A. 1915}{27}$). The fol-

lowing years the numerator remains always the same, but the denominator showing the number of the plot varies. When such a fraction is written in a double circle it shows that the test period is finished and that the material will henceforth be used solely for propagation. Such is the plan adopted for selecting annual plants ; a different one is used for biennials.

II. — OBSERVATION REGISTER. — The data inscribed are : —

1) *Resistance to low winter temperature.* — The damage sustained by frost is estimated by the number of plants attacked and the extent to which they suffer as shown by total or partial yellowing of the leaves. The total unfavourable action of weather factors during winter is measured by the percentage of dead flowers. It is possible to draw up an empiric scale of resistance for each family : — a) resistant ; b) fairly resistant ; c) sensitive ; etc.

2) *Number of failures* (due to various causes : bad preparation of the soil, low germinating capacity of the seed, injurious insects or animals, unfavourable weather, etc.).

3) *Quality of the soil.* — Empiric scale : — a) fertile, in excellent cultural condition ; b) good ; c) normal, of average fertility ; d) bad ; e) very bad.

4) *Rate of growth at the beginning of the growing period.* — This is very useful to the plants to enable them to escape disease, the competition of weeds, etc. An empiric scale of values may be drawn up to distinguish the

families in which this character is most marked, by beginning the observations two weeks after the plants appear above the soil.

5) *Rust*. — The intensity of the attack in autumn, spring, and during and after earing is determined empirically, and the parasitic fungus (*Puccinia glumarum*, *P. graminis*, etc.) specified.

6) *Ustilago*, *Tilletia*, and *Helminthosporium*. — The number of plants attacked is counted by determining the degree of susceptibility of the families to these fungi. The seed must not be disinfected.

6) *Length of stem*. — Empiric scale: — *vl* = very long; *l* = long; *a* = average length, *s* = short; *vs* = very short

8) *Irregular development of stems*. — This may be due to local environmental causes, or may show great variability in the descendants, frequent in rye. In any case, extreme plants should be eliminated.

9) *Lodging*. — Pre-disposition to lodging is due to one of the following causes: — *a*) over-dense growth, *b*) too feeble resistance of the soil due to the action of water, wind, etc., *c*) weak adherence of the root system to the soil; *s*) defective development or breaking of the roots; *e*) breaking of the tap root (beans); *f*) over-weighting, caused by excessively heavy ears, water, etc.; *g*) weakening of the base of the stem caused by disease (*Ophiobolus graminis*, etc.), insects, or frost; *h*) defective anatomical structure of the stem; *i*) irregular development of the stems; *j*) defective formation of the nodes by reason of which the stems bend instead of remaining straight.

10) *Fragility of stem*. — Frequent in rye and resulting from a lack of elasticity. The percentage of broken stems is determined.

11) *Colour of leaves*. — Dark, normal, or light.

12) *Foliage*. — The more it increases, the more it favours evaporation, which is undesirable. It is estimated by an empiric scale ranging from 1 to 5. Short notes on the shape of the leaves are also made.

13) *Shape of the ears*. — *A*) cylindroidal: — *a*) very long and fine, *b*) long; *c*) normal cylindroid; *d*) compact; *e*) very compact; — *B*) cone-shaped: — *a*) long; *b*) of average length; *c*) short. It is noted whether the end is pointed or blunt.

14) *Colour of ears*. — If "dark", "light", and "intermediate" are not enough, a short note is made of the colours white, yellowish-white, pinkish-yellow, red, dark red, brown, or black.

15) *Presence or absence of awns*. — This is shortly noted, showing whether the awns be long, short or rudimentary. The presence or absence of down on the glumes is also noted.

16) *Arrangement of ears*. — Straight ears are less likely to lose their grain at harvesting time than curved ones or those bent towards the ground (nutation). On an empiric scale it is shown whether the ear is straight (1), the maximum degree of nutation (5), and the intermediate degrees (2, 3 and 4).

17) *Ripeness*. — To determine the date of ripeness it should be enough to note the moment at which the straw turns yellow. This yellowing, however, may occur so simultaneously in different varieties or families that only minimum differences can be observed. It is, therefore, necessary

6) *Grains a)* number per plant ; *b)* weight per plant ; *c)* size as shown by the weight of 1000 grains calculated from three lots of 100 sifted grains of the 15 non-élite plants.

7) *Quality of the grain*, valued by its shape, colour, and suitability for use as seed, expressed by one of the following three degrees : — *a)* suitable or very suitable ; *b)* eventually suitable ; *c)* useless.

IV. — **BEHAVIOUR OF CHARACTERS IN THE DIFFERENT STRAINS AND FAMILIES.** — This is estimated by observations made on growing plants and during the work of selection. To determine with certainty the inheritance of the different characters it is necessary to compare the results obtained for each character during four consecutive years, so as to eliminate the effect of annual variations due to external causes.

V. — 1) **GUIDE TO WORKING METHODS**; 2) **DIARY OF WORK** ; 3) **METEOROLOGICAL OBSERVATIONS** ; 4) **GERMINATION TESTS.** —

1) In view of possible changes in the staff of the Station there is a guide giving every thing necessary for the instruction of new members in the methods of selection, the registration of observations, inventories, weather forecasts, etc.

2) The diary completes the guide. Two pages of it are filled up each month. That on the left shows daily the work done and the labour employed, that on the right shows:—*a)* the monthly meteorological observations; *b)* notes on the conditions of the crops ; *c)* reception and dispatch of samples of grain and other articles ; *d)* notes on the correspondence ; *e)* various notes.

3) The daily meteorological observations are kept in a special register.

4) The results of germination tests are kept in a special register.

n the vegetation of rye.

Date of harvest																			
Stem			Leaves			Ears			Ripening			Number of plants per plot							
Length	Uniformity	Lodging	Fragility	Colour	Foliage	Shape	Colour	Presence or absence of awns	Nutation	Date of earing	Date straw turns yellow	Average	Elite	Other plants	Diseased or with a single stem	Foreign types	Total	Mechanical damage	Remarks

581. — Selection of "Gentil Rosso" Wheat in Italy. — VIGIANI D., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. LII, Pt. I, pp. 3-13. Modena, January, 1919.

The results are given of the selection of "Gentil rosso" wheat undertaken by the author in 1894 in the experiment fields of the Agricultural Institute of Vegni, province of Arezzo.

To estimate exactly the value of selected "Gentil Rosso" wheat a series of comparative observations of the different varieties of wheat cultivated in the experiment fields of this institute were made from 1912 to 1918. The observations dealt with *productivity, tillering, development, resistance to rust, earliness, and resistance to lodging*.

Productivity. — For the years 1912, 1915, and 1918, the average yields in lb. per acre were : — Selected Gentil Rosso, 695 ; Ordinary Gentil Rosso, 1 318 ; Gentil Rosso \times Noé, 1 754 ; Vilmorin inversable, 1 649 ; Cologne \times Shirref, 1 549 ; Fucense, 1 558 ; Rieti, 1 549 ; Calbigia Bianca, 1 514 ; Noé, 1428.

Selected Gentil Rosso, is therefore, a little inferior to the hybrid Gentil Rosso \times Noé, which is not valued by farmers because of its short, coarse, unsubstantial straw, its rather late ripening, and low resistance to rust.

Selected Gentil Rosso is much superior to the ordinary type in yield (377 lb. per acre). It is also distinguished by a greater development, short, squat and compact ear, very short awns, and close spikelets on the rachis.

Tillering. — The different varieties may be classed in the following decreasing order : — 1) Gentil Rosso ; 2) Gentil Rosso \times Noé 46 ; 3) Rieti ; 4) Fucense ; 5) Vilmorin Inversable ; 6) Cologne \times Shirref ; 7) Calbigia Bianca ; 8) Noé.

Development. — The varieties may be classed in the following order : — 1) Gentil Rosso ; 2) Cologne \times Shirref ; 3) Calbigia Bianca ; 4) Fucense ; 5) Rieti ; 6) Vilmorin inversable ; 7) Gentil Rosso \times Noé 46 ; 8) Noé.

Resistance to rust. — Order :— 1) Rieti ; 2) Fucense ; 3) Gentil Rosso ; 4) Vilmorin inversable ; 5) Cologne \times Shirref ; 6) Gentil Rosso \times Noé 46 ; 7) Calbigia Bianca ; 8) Noé.

Earliness. — 1) Calbigia Bianca ; 2) Gentil Rosso ; 3) Cologne \times Shirref ; 4) Fucense ; 5) Rieti ; 6) Gentil Rosso \times Noé 46 ; 7) Noé ; 8) Vilmorin Inversable.

Resistance to lodging. — 1) Noé ; 2) Gentil Rosso \times Noé 46 ; 3) Vilmorin inversable ; 4) Gentil Rosso ; 5) Cologne \times Shirref ; 6) Rieti ; 7) Fucense ; 8) Calbigia Bianca.

Unfortunately, except for its qualities of productivity, development, earliness, etc., Gentil Rosso leaves much to be desired in its resistance to lodging, especially when grown out of its native district, and sown too close, or in soil very rich in nitrogenous matter. In 1902, after having obtained great improvement by mass selection, the author started pure line selection with the object of isolating a new type which, while preserving the qualities of selected Gentil Rosso, would also be very resistant to lodging (1). The selection work proceeded as follows :—

(1) See June, 1916, (Paper by Dr. PATIANCE on the Selection of Cereals in Italy). (Ed.)

1) *Initial choice* of parent ears from the products of the systematic selection long practised at the Vegni Institute, care being taken to choose the morphological and physiological characters corresponding perfectly to the end in view.

2) *Cultural tests*, by sowing the seed of the parent ear on a special plot.

3) *Repetition of cultural test* during two or three consecutive years in order to estimate with certainty the qualities of a given family and to eliminate all those with undesirable characters or of uncertain value,

4) *Cultural propagation tests* with seed from the plots giving satisfactory results.

5) *Inscription of family in the genealogical book* after it has been subjected to the propagation test.

6) *Control test* to assure the constancy of the types.

Of the families now under observation, the family 5 ($84 - \frac{12}{16}$) is distinguished. In addition to being productive, resistant to rust, and very early, it is also very resistant to lodging, thus approaching the type the selection work aims at.

582 - **Crosses Between Barley with Blue Grain and Barley with Pale Yellow Grain in Japan; Apparent Segregation in Mosaic in the F_1 explained by Xenia.** - I MRYAZAWA B, Ueber die mosaikartige Spaltung eines Gerstenbastards, in *The Botanical Magazine*, Vol CXX, No 359, pp 359-369 + 6 Tables + 4 Figs. Tokyo, November, 1916 - II SÔ, M and IMAI, Y, On the Xenia in the Barley, *ibid*, Vol. XXXII, No 382, pp. 205-214 + 10 Tables. Tokyo, October 1918

I. — MOSAIC SEGREGATION IN AN F_1 BARLEY HYBRID. — In 1913 the author made reciprocal crosses between Sekitori barley with dark blue grain, cultivated for a very long time in Japan, and Goldenmelon two rowed barley with very pale yellow grain, a native of Australia. The following years he studied the successive descendants of one of these crosses (Sekitori \times Goldenmelon).

F₁ generation (1914) — In each reciprocal cross the ears had both dark blue and pale yellow grain in varying ratios, but the total number was almost equal for all the plants together (1009 dark blue grains and 1019 yellow grains). From the first generation of hybrids, therefore, there seemed to be segregation of characters which usually does not begin till the second generation. To study the behaviour of the following generations the cross Sekitori \times Goldenmelon was used exclusively, the dark blue and pale yellow seeds being sown separately.

F₂ generation (1915) — The descendants of the blue grain of the F_1 included plants with all blue grain, and intermediate plants with blue and yellow grain (as in the F_1) but no plant with exclusively yellow grain.

The descendants of the yellow grain of F_1 included plants with all yellow grain and intermediate plants with blue and yellow grains (as in F_1), but no plant with exclusively blue grain.

The descendants of the cross Sekitori \times Goldenmelon to the F_2 , may therefore, be represented as follows :

	P	F	F_2
Sekitori \times Goldenmelon (blue grain) (pale yellow grain)	{	with both blue . .	Plants with all blue grain
		and	Intermediate plants with both blue and yellow grain
		yellow grain. . .	Plants with all yellow grain
			Intermediate plants with both blue and yellow grain

The blue grain and yellow grain of the F_1 were, therefore, partly homozygous and partly heterozygous.

F_3 generation (1916). — The descendants of F_2 plants with grain all of one colour, either blue or yellow, also had this character. The descendants of F_2 plants with intermediate character (both blue and yellow grain), however, included three different types : - a) exclusively blue grain ; b) both blue and yellow grain ; c) exclusively yellow grain. The number of plants of each type (193, 307, 115) did not agree with the theoretical ratio 1 : 2 : 1 corresponding to the calculated numbers 153.75 : 307.50 : 153.75. There was an excess of plants with exclusively blue grain (193, compared with 153.75) and, consequently too few exclusively yellow plants (115, compared with 153.75). The author could find no satisfactory explanation of this.

Conclusions. - This is a case of mosaic segregation occurring already in the F_1 . Several examples of this are known, especially for the colour of the flower in *Veronica longifolia* (DE VRIES), for the awns in wheat (FRUWIRTH), and for the colour of the leaves in *Pelargonium zonale* (BAUR).

This last example resembles in many ways that studied by the author. Crossing normal green-leaved varieties of *Pelargonium* with white-leaved varieties, gives an F_1 composed of a mosaic of green and white tissues. The shoots of these hybrids differ in appearance according to their origin. Those from a point where all the cells are green have green ramifications, those from a point with all white cells have white ramifications, and those from a point with both white and green cells have mosaic ramifications and leaves. A similar phenomenon occurs in the hybrid Sekitori \times Goldenmelon. The vegetative segregation of hereditary factors causes the appearance of two types of tissues in the ear which is forming, and there are cells containing the dark blue determinant, and other cells without this determinant. The flowers of this ear might come from : —

1) A group of cells all having the dark blue determinant. In this case the male and female organs will both have this determinant, and the seed produced by self-fertilisation will be dark blue.

2) A group of cells without this determinant ; the grain will be pale yellow.

3) A group of mixed cells (with and without the dark blue determinant). The male and female organs will be opposite in character, and self-fertilisation will produce either blue grain (female organs with the determinant), or yellow grain (female organs without the determinant), all heterozygous.

II. — ON THE XENIA IN THE BARLEY. — The authors made a fresh study of the case described by MIYAZAWA and showed that it is due, not to a vegetative segregation of determinants (mosaic), but to double fertilisation affecting both the ovule and the kernel of the embryo sack, and resulting in the formation of a xenia. MIYAZAWA considered that only the cells of the pericarp and outer spermoderm layer were pigmented, whereas the pigment (anthocyanine) occurs also in the aleuron cells forming the external layers of the endosperm. This suggests the possibility of a fusion of the kernel of the embryo sack with the secondary kernel of the pollen tube, i. e. double fertilisation. This was proved experimentally. A variety of barley with blue grain (with pigment) fertilised with the pollen of a variety with pale yellow grain (without pigment), produced blue, but heterozygous (Bb) grain. A reciprocal cross gave the same results. This case is similar to many other cases of xenia in maize, rice, millet, etc.

The varieties of barley used in the reciprocal crosses were:—

With blue grain: — Sekitori, Okina-mungi, Chôsen, Rokkaku - Chevalier, Tanikazê, Nijô-sansha, and Hozoroi.

With pale yellow grain: — Goldenmelon, Saitama-hambô, Hizahachi, Shiromugi, and Kiemon.

Each cross gave an F_1 with blue grain and pale yellow grain in numbers corresponding fairly well to the ratio 3 : 1. Of a total of 10 002 grains, 7 498 were blue and 2 504 yellow. These figures are very near to the theoretical ones 7501.5 and 2500.5, corresponding to the ratio 3 : 1.

This ratio may be illustrated by the following gametic formulae:— if B represents the presence of the blue pigment, and b its absence, F_2 will include four different types of grain, three of which will be blue BB--bb--Bb, and one pale yellow, bb.

The ratio 1 : 1 observed by MIYAZAWA may be explained by the fact that half of the grain he considered to be pale yellow was really a very pale blue, difficult to identify, but existing nevertheless.

Conclusion. — All the facts observed by the authors tend to show the phenomenon in question to be a case of xenia. This is also the opinion expressed by S. TAKEDA in a note on the same subject.

583 - Comparative Variability of Mangel Wurzels and Sugar Beets in the First Descendence of a Single Parent Plant; Investigations in Bohemia — I. ROMÁDKO, J. in the *Zeitschrift für Zuckerindustrie in Böhmen*, Year XLII, Pt. 9, pp. 581 - 601 + 2 Tables + 5 Figs. Prague, June, 1918.

The author studied the variability of the characters in the first descendence of a single mangel wurzel. He gives the results obtained, and compares them with those obtained in a similar study of the first descendence of a sugar beet made by K. ANDRLIK and J. URBAN (published in the *Zeitschrift für Zuckerindustrie in Böhmen*, 1913-1914, p. 339).

Characters studied: — Weight of root; weight of epigeal part; sugar content; dry matter content of the root.

Values calculated: — Arithmetical average or average value (M — typical deviation σ ; coefficient of variation (v); average probable error (m) for each of these three values.

To calculate the *typical deviation* use was made of the formula $\sigma = \sqrt{\frac{\sum p D^2}{n}}$, in which D^2 = the square of each deviation, D , from the average M (e. g. average weight of all the roots studied), p = the number of plants (or cases) showing this deviation, Σ = the total of all the products, pD^2 , obtained, and n = the number total of plants examined.

To calculate the *coefficient of variation* the formula $v = \frac{\sigma}{M}$ was used, i. e., the typical deviation, σ , was divided by the average value M of the character considered for a whole group of plants.

To calculate the *average probable error* which may be made in calculating the average value M , the typical deviation, σ , and the coefficient of variation, v , the formulae used were : —

$$m_M = \frac{\sigma}{\sqrt{n}} \quad m_\sigma = \frac{\sigma}{\sqrt{2n}} \quad m_v = \frac{v}{\sqrt{2n}}$$

I. — VARIABILITY OF THE MANGEL WURZEL. — In 1914 a seed plant of Eckendorf mangel was isolated by a muslin bag in order to obtain seed plants of known origin by self-fertilisation. These were sown under as uniform environmental conditions as possible and the plants derived from them used in the investigations.

Variability in the weight of the root — The extent of the variation (2156 gm) is enormous, three times greater than in the sugar beet (640 gm.). The average weight $M = 999.2$ gm. By dividing the plant studied according to the weight of the root into groups differing by 200 gm. successively, the following list was obtained. In this list the upper line represents the progressive limits in weight of each group (100-300, etc.) and the lower line, opposite the space () between the limits of each class, the number of plants (frequency) in each group :

3 7 16 18 7 14 12 5 1 1 1

Here is seen, as in all cases of fluctuating variation, the customary fact that the groups nearest the average values are best represented, for, in the groups between 500 and 1100 gm. there are 16, 18, and 27 plants successively, as compared with small numbers in the extreme cases.

The typical deviation $\sigma = \pm 396.7$ gm., with a probable average error of $m_\sigma = \pm 27$ gm. The coefficient of variation $v = 39.7 \pm 2.7$; it is really very high, and similar ones are rarely found in the animal or vegetable worlds.

Variability in weight of the epigeal part. — The extent of the variation (357 gm.) is much smaller than that for the weight of the root (2156 gm.). The average weight $M = 180.7$ gm. The division of the plants into groups differing in weight by 40 gm. successively gives the following list :—

0—40—80—120—160—200—240—280—320—360—400 g
1 3 10 29 31 14 11 3 3 1

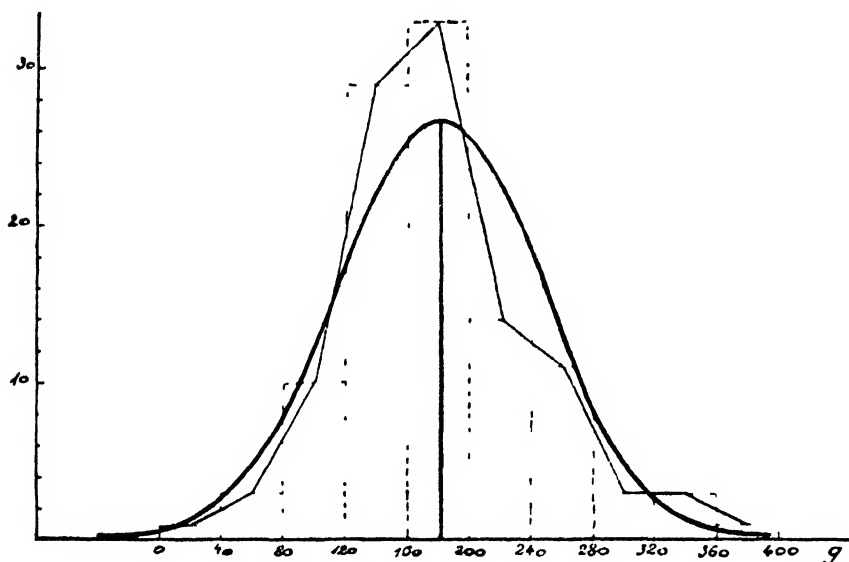
• As for the variability in weight of the root (and other characters), the number of plants (frequency) belonging to each group may be represented graphically by a Quételet curve such as that reproduced.

Variability in the dry matter content of the root. --- The variation (5.47 %) is a little smaller than for the sugar beet (7.86 %). The average content $M = 12.28$ %. The distribution of the plants into groups, the percentage of which differs by 0.5 % successively, gives the following list :--

9,5 — 10,0 — 10,5 — 11,0 — 11,5 — 12,0 — 12,5 — 13,0 — 13,5 — 14,0 — 14,5 — 15,0 %
2 3 10 15 16 14 15 10 10 8 2

The typical deviation $\sigma = \pm 1.175$ % ± 0.08 %. The coefficient of variation $v = 9.57 \pm 0.65$.

Weight of the epigeal part : curve of frequency



Abscissa = weight groups

Ordinates = number of plants (frequency)

The broken curve is that of true frequency

The regular (corrected, or QUÉTELET) curve represents the calculated frequency.

Variability in the sugar content. — The extent of the variation is 5.85 % as compared with 4.65 % for the sugar beet. The average sugar content $M = 7.68$ %. The division of the plants into groups differing by 0.5 % successively gives the following list :

1.4 — 1.9 — 5.1 — 5.2 — 6.1 — 6.9 — 7.4 — 7.9 — 8.4 — 8.9 — 9.4 — 9.9 — 10.1 %
2 3 4 8 12 17 16 13 14 10 6 3

Typical deviation $\sigma = \pm 1.25$ % ± 0.09 %. Coefficient of variation $v = 16.31 \pm 1.11$.

II. — VARIABILITY OF THE SUGAR BEET. — The principal results of the investigations of ANDRLIK and URBAN may be summarised as follows :

Variability in the weight of the root. — Average weight $M = 331$ gm. Division of plants into groups differing by 75 gm. successively:

75—150—225—300—375—450—525—600—675—750 gm.
1 12 34 28 21 8 . . 1

Typical deviation $\sigma = \pm 94.2$ gm. Coefficient of variation $v = 28.46$ (compared with 39.7 for the mangel wurzel).

Variability in weight of the epigeal part. — Average weight $M = 357$ gm. Division of plants into groups differing by 75 gm. successively :—

75—150—225—300—375—450—525—600—675—750—825 gm.
2 10 30 20 23 10 5 2 2 1

Typical deviation $\sigma = \pm 115.7$ gm. Coefficient of variation $v = 32.4$ (compared with 35 for the mangel wurzel).

Variability in the dry matter content of the root. — Average content $M = 23.56$ %. Division of plants into groups differing by 1 % successively.

19—19—20—21—21—23—24—25—26—27 %
1 1 3 16 18 25 21 15 5

Typical deviation $\sigma = \pm 1.62$ % Coefficient of variation $v = 6.88$ (compared with 9.57 for the mangel wurzel).

Variability of sugar content — Average sugar content $M = 16.3$ % Division of plants into groups differing by 0.5 % successively :—

13.5—14.0—14.5—15.0—15.5—16.0—16.5—17.0—17.5—18.0—18.5—19.0 %
1 2 1 20 24 20 11 10 10 5 1

Typical deviation $\sigma = \pm 0.98$ % Coefficient of variation $v = 6.02$ (Compared with 16.31 for the mangel wurzel).

III. — COMPARATIVE VARIABILITY OF THE MANGEL WURZEL AND SUGAR BEET. — The following table compares the variations of the characters of these plants.

Characters and their variation		Mangel wurzel (108 plants)	Sugar beet (105 plants)
Weight of root	Extent of variation gm	2156	640
	Average value gm	999.2 \pm 38.2	331 \pm 9.2
	Coefficient of variation	30.7 \pm 2.70	38.16 \pm 1.96
Weight of epigeal part	Extent of variation gm.	357	675
	Average value gm.	180.7 \pm 6.09	357 \pm 11.3
	Coefficient of variation	35.0 \pm 2.38	32.1 \pm 2.24
Dry matter content of root	Extent of variation %	5.17	7.86
	Average value %	12.28 \pm 0.11	23.56 \pm 0.16
	Coefficient of variation	9.57 \pm 0.65	6.88 \pm 0.17
Sugar content	Extent of variation %	5.85	4.65
	Average value %	7.68 \pm 0.12	16.30 \pm 0.10
	Coefficient of variation	16.31 \pm 1.11	6.02 \pm 0.42

In both the mangel wurzel and the sugar beet, therefore, there is great variability in the characters considered. This is due partly to internal factors, and partly to external ones. The variability of the weight of the root and the weight of the epigeal part is much greater than that of the sugar content or dry matter content.

In the sugar beet the sugar content varies less than in the mangel wurzel. This seems to be the result of continual selection aiming at the increase of the sugar content. This character has, therefore, become relatively stable, whereas in the wild beet it varies enormously. On the other hand, in the selection of the sugar beet relatively less attention has been paid to the weight of the root, and this character has remained more variable than the preceding one. It appears, moreover, much more sensitive to external influences than are the sugar content and dry matter content. This last varies relatively little, hardly more than the sugar content.

In the mangel wurzel, unlike the sugar beet, selection has aimed almost exclusively at increasing the weight of the root, only much later was it concerned with increasing the sugar content, which has thus remained very variable. Moreover, it must be acknowledged that the weight of the root is also variable by reason of its sensitiveness to external influences, so that, in spite of continual selection, this character cannot become stable. The dry matter content varies little as a results of selection which has aimed at increasing it.

On the whole the characters studied vary more in the mangel wurzel than in the sugar beet.

584 - Studies on the Inheritance of Certain Characters in the Castor Oil Plant —
 WHITE, O., in the *Brooklyn Botanic Gardens Memoirs*, Vol. I, pp. 513-520 + Plates
 XXIII-XXVIII, Brooklyn, N. J., 1918

Although the genus *Ricinus* is made up of a single widely distributed species, *R. communis*, it presents many forms which have from time to time been considered as distinct species. These forms transmit many of their characters integrally to their descendants. This has been shown by control cultural experiments made at the Brooklyn Botanical Garden with numerous pure strains of the first, second and third generation. A series of crosses between extreme forms gave in every case a perfectly fertile and normal F_1 and F_2 hybrids. The paper under review gives the results of crosses made to study the inheritance of a dozen or more distinct characters — stem colour, presence or absence of pruina, dehiscence and indehiscence of capsules, colour of the spermoderm, shape and size of the seed, growth, etc.

STEM COLOUR. — There are five different colours: 1) light green, 2) green tinged with red; 3) carmine; 4) mahogany red; 5) purple (dark red).

Chemically these colours are identical; the pigment contains traces of chloroform, insoluble in alcohol, xylene, and pure chloroform. The different shades are due to: 1) the presence or absence of factors regulating the concentration of the colour; 2) the presence or absence of a factor regulating the distribution (design) of the colour, in the absence of

which the stem and leaves are mahogany red when there is no pruina or purple when there is pruina.

Results of crossing experiments: green tinged with red × green. — F_1 = green tinged with red; F_2 = green tinged with red and green in the ratio 3 : 1.

Green tinged with red × mahogany red. — F_1 = carmine; F_2 = green tinged with red, carmine, and mahogany in the ratio 1 : 2 : 1.

Green tinged with red × carmine. — F_1 = carmine; F_2 = carmine and green tinged with red in the ratio 3 : 1.

The results obtained for the F_1 and F_2 of the three crosses may easily be explained in each case by the presence or absence of a single factor. There would be, therefore, determinants or genetic factors in all the crosses.

PRESENCE OR ABSENCE OF PRUINA. — There are types of castor-oil plants without pruina. When these are crossed with normal types, the F_1 plants have pruina and the F_2 plants have and have not pruina in the ratio of 3 : 1.

Dehiscence of the capsules. — There are two forms, dehiscent and indehiscent.

1 A) *Dehiscence.* — The ripe capsules, open spontaneously with violence, scattering the seeds around to a great distance. This is probably caused by cells which, when ripe, rapidly lose their moisture and contract causing the pod to break and expel the seeds. This is an unfavourable character and necessitates frequent harvesting (at least twice a week) to avoid the loss of large quantities of seed. The walls of dehiscent capsules are very thick and tough.

B) *Indehiscence.* — The seed adheres to the walls of the fruit when it is completely ripe.

The cross dehiscent × indehiscent form, gave in the F_1 , dehiscent plants and, in the F_2 , both dehiscent and indehiscent forms in the ratio 9 : 7. Dehiscence seems, therefore, to be due to two factors, A and B.

In this case the dehiscent form would be equal to AABb, and the indehiscent form, aabb. When crossed these types would give, in the F_2 , dehiscent and indehiscent plants in the ratio 9 : 7.

COLOUR OF THE SPERMODERM. — The spermoderm may be white, brownish yellow, various shades of red, grey, brown, or black. In the crosses, the chocolate brown colour is dominant to the black, red, white, and grey. The red colour seems to depend on more than one determinant. In every case there are factors which modify the fundamental character by determining the appearance of different shaped markings: 1) very fine streaks; 2) large streaks; dappled or speckled; 3) small spots.

By crossing plants with fine streaked seed with plants with large streaked seed an F_1 is obtained with fine streaks, and an F_2 with fine and big streaks in the ratio 3 : 1. The character, therefore, evidently depends on one factor.

SIZE AND SHAPE OF SEED. — Ovoid × spheroidic = F_1 : ovoid — F_2 : ovoid and spheroidic in the probable ratio of 9 : 7. The shape of

the seed is, like dehiscence, due to two factors. With respect to size and weight, there are types of castor oil with seed 1 cm. long weighing 0.1 gm. and seed 2.5 cm. long weighing 1 gm. When these are crossed, the F_1 has intermediate forms in all stages, and the F_2 has extreme types with a complete set of intermediate forms.

The other characters, such as periodicity, length of stem, growth, shape of leaves, etc., are also mendelian, but the experiments which have been made so far, do not warrant any conclusions as to their gametic structure.

585 - **Montgomery Seedleaf. A New, and very Productive Tobacco Hybrid Obtained in Ohio, U. S. A.** — HAUSER, T., in *The Journal of Heredity*, Vol. IX, No. 8, pp. 354-356 + 4 Figs. Washington, December, 1918.

In a series of tobacco hybridisation and selection tests made at the Ohio Agricultural Station in 1903, the hybrid Montgomery Seedleaf, obtained from the cross Washington (Ohio) Seedleaf \times Big Graham, proved much superior to the ordinary varieties of tobacco. It differs distinctly from its parents, both of which have drooping leaves, by its straightness. Its height (above that of a man) and vigorous vegetation make it very productive; it often gives yields exceeding 2000 lb. an acre. Another valuable quality is its resistance to drought. It is true that excessive drought hinders flowering, but when it is over the plant grows with a new vigour. This tendency sometimes makes it necessary to top it before the floral buds form.

This new variety, already adopted by tobacco growers in south-west Ohio, was awarded first prize in a competition for which seventy other varieties were entered.

586 - **Variability of Characters in the Radish and How to Reduce it by Selection Investigations in the United States.** — DARRIN, E. F. and COHEN, R. H. in *The Journal of Heredity*, Vol. IX, No. 8 pp. 357-361 + 1 Fig. Washington, December, 1918.

The commercial varieties of radish (*Raphanus sativus*), even the best guaranteed, show great variability in the shape and size of the root, thus producing heterogeneous material. The authors give the results of a series of investigations aiming at determining the causes and extent of this variation, as well as the practical application of the results obtained. The varieties used were Scarlet Globe and White Box, globular in form and developing fully in four weeks, and White Icicle, cylindro-conical in form and developing fully in six weeks. The characters studied were weight of the root (in grammes), and length and breadth of the root (in millimetres).

By dividing the length of the root by its breadth, a figure was obtained which gave a fairly exact idea of its shape. In the globular types this quotient remained near 1, whereas in the cylindro-conical shapes it varied between 4 and 5.

WEIGHT OF THE ROOT. — This is the most variable of the characters studied, the index of variability being as much as 49.15 % for the Scar-

let Globe variety, 66.72 % for White Box, and 55.34 % for White Icicle. In the first variety the average weight of the root of all the plants was 12.58 gm., and the most common weight 10.7 gm. (observed in 17 % of the plants). In the second variety these figures were 17.22 gm. and 3.8 gm., and, in the third, 47.59 gm and 30.5 gm.

The true frequency curve, instead of resembling the corrected QUE-
TÉLET (1), curve, was greatly displaced towards the values below the average, especially for the White Box variety.

LENGTH AND BREADTH OF ROOT. -- The principal results obtained are given below ; they show the variability of these two dimensions.

Variety	Length of root		Breadth of root	
	Average length	Commonest length	Coefficient of variability	Coefficient of variability
Scarlet Globe. . .	35.49mm	35.5mm and 29.5mm in other words the frequency curve has two points, showing the impurity (heterogeneity) of this variety	25.00 %	23.00 %
White Box . . .	29.42mm	30.5mm	25.25 %	30.13 %
White Icicle . .	124.55mm	112.0mm	27.55 %	12.02 %

CORRELATIONS BETWEEN WEIGHT AND LENGTH OF THE ROOT BETWEEN WEIGHT AND BREADTH OF THE ROOT -- Although always reaching very high values, the first and second correlation differ inversely according to the varieties. In White Icicle, the first (coefficient 0.884) exceeded the second (0.874), showing that the length of the root is more important than the breadth, or, in other words, that, in this variety, the longest roots are the heaviest. In Scarlet Globe and White Box the contrary is true, the second correlation (0.881 and 0.901 respectively) exceeding the first (0.650 and 0.826), showing in this case, the preponderating influence of the breadth of the roots over their weight.

SHAPE OF THE ROOT. -- As this character is expressed by the quotient of two very variable characters, it is perforce very variable itself. This is especially true in the Scarlet Globe variety, in which the coefficient of variability reaches the very high value of 90.39 % as compared with 21.96 % in White Box and 26.55 % in White Icicle.

PRACTICAL APPLICATIONS. -- From a commercial point of view, the extreme heterogeneity of the product is a serious fault, for it makes it necessary to eliminate a considerable number of the radishes grown for the market.

This excessive variability is due to the fact that the seed is harvested and sorted without any standard for selection, and also to the fact that selection is made difficult by a) the underground position of the root

(1) See No 553 of this Review (Ed.)

which makes direct observation impossible ; b) cross-fertilisation, the radish being almost entirely self-sterile ; to assure self-fertilisation, difficult and careful operations are necessary.. The following two methods for improving radishes, are proposed ; both are easy to apply practically : —

1st method. — 1) Determine the most advantageous type from the point of view of weight, shape, date of full development, etc.

2) Choose the plants most closely resembling the desired type ; to examine the roots well they must be carefully freed from all soil adhering to them ; the plants found to be the best are then replanted, a good distance being left between varieties which may hybridise.

3) Sow the seed of each plant so chosen in a separate plot or row ; for the subsequent production of seed only the plants most faithfully reproducing the selected types will be chosen.

2nd method. — To prevent the roots from being uncovered during vegetation, transform the plant artificially into a pseudo-biennial plant (1). To do this, collect the roots when they have reached market size, choose the best, and keep them in a store or silo during winter ; replant them in spring. The seed obtained the second year must be sown in separate plots or rows for each plant. Proceed then as in the first method.

587 - **Investigations into Seeds, in the United States.** - I HARRINGTON, G T and CROCKER, W R. *Estimation of Seeds to Desiccation*, in the *Journal of Agricultural Research*, Vol. XIV, No. 12, pp 525-541 + Bibliography of 14 Publications. Washington, September 16, 1918. — CROCKER W and HARRINGTON G T, *Catalase and Oxidase Content of Seeds in Relation to their Dormancy, Age, Vitality, and Respiration*; *Ibid.*, Vol. XV, No. 3, pp 137-144 Figs. + Bibliography of 37 Publications. Washington.

I. — **RESISTANCE OF SEEDS TO DESICCATION.** — The artificial desiccation of seeds to hasten their ripening has raised the question whether this process may prove detrimental to the seed. Up to the present the opinion of workers on this subject has varied greatly.

The authors subjected seeds of wheat, barley, Sudan grass (*Holcus halepensis sudanensis*), Kentucky blue grass (*Poa pratensis* L) and Johnson grass (*Holcus halepensis*) to desiccation under varying conditions and during different periods. They found that the germinative faculty was not appreciably affected when dried to less than 1 % of moisture and, in the case of Kentucky blue grass and Johnson grass, when the moisture content was reduced to 0.1 %, although the vigour of Kentucky blue grass seedlings was greatly reduced. This vigour was still more reduced by drying in a vacuum oven for 6 hours at 100° C., although the germination capacity was not materially affected.

II. — **CATALASE AND OXIDASE CONTENT OF SEEDS IN RELATION TO THEIR DORMANCY, AGE, VITALITY, AND RESPIRATION.** — At the Seed Testing Station of the U. S. Department of Agriculture Bureau of Plant Industry it was found that alternating temperatures favour the germination of seed of certain fodder grasses. The study of this phenomenon led to that of delayed germination and the physiology of germination in general.

(1) See R. J. M., 1919, No. 9 (Ed.)

The catalytic activity of the seeds was first determined by measuring the volume of oxygen given off in an excess of hydrogen peroxide solution neutralised to phenolphthalein by the addition of deci-normal caustic soda. It was found that certain factors modify this activity. For instance, crushing the seeds excessively, preserving powdered seeds in a desiccation or drying seeds which have been kept in a germinator, reduces the catalytic activity. In a sample of wheat the catalytic activity of the embryo was found to be 28 to 29 times that of the endosperm, and the same relation exists between the oxydase and respiration activities.

Unripe Sudan grass and Johnson grass seeds have a greater catalytic activity than ripe ones.

The physiologically inactive organs of seeds have only a small fraction of the catalytic activity of the caryopses. The oxydases are, however, as active in the vital as in the non-vital organs.

Retention in the germinator is not so favourable to germination, but considerably reduces the catalytic activity and respiratory intensity of Johnson grass seeds. The effect on the oxidase activity is less marked.

The optimum temperature for delayed ripening in dried peach kernels seems also to be the optimum for increasing catalase activity. Oxydase activity, however, decreases with delayed ripening, although the auto-colouration of the mass of powdered seed exposed to the air increases. During the germination of seeds of gramineae the catalytic and respiratory activity increase rapidly, but there is no intensification of oxydase activity.

In certain seeds, such as those of Johnson grass, there is a close correlation between catalytic activity and respiratory intensity, but no relation between these two factors and the vitality of the seed or the vigour of the seedlings springing from it.

No general conclusion as to the catalytic activity of all the seeds tested can be drawn from the results. There is, however, reason to believe that seeds may be divided into different physiological types for which more or less general criteria may be laid down. It may also be said that the catalytic activity of seeds is more parallel to physiological behaviour than is the oxydase activity.

588 - **The Work of the French Sugar Beet Seed Commission for the Year 1918** (1). — SAILLARD, E, in the *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. V, No. 9, pp. 323-330. Paris, March, 1919.

The author summarises the work done during the year 1918 by the Sugar Beet Seed Commission, instituted at the French Ministry of Agriculture. The program included: - The institution of competitions (a competition between the French producing houses and a competition for machines for drying the seed); the *foundation of a Selection Station*, to carry out the improvement of the best of the present varieties or the creation of new varieties and to study the problems relating to the production of sugar beet seed; and, finally, the *institution of cultural tests* in order to improve the cultivation of the industrial sugar beet.

(1) As regards sugar beet seed in France, see R., Dec., 1917, No. 444. (Ed.)

The results obtained in the Selection Laboratory are given below : —

In order to improve existing varieties and to create new ones, the selectors started with some of the best varieties grown industrially. Three years are required to work out one generation : — *First year*: the seed is sown in spring and the beets are harvested in autumn — *Second year*: the best beets are replanted in spring; in the autumn their seed is gathered separately and preserved in separate bags — *Third year*: by means of a cultural test, the seed from each bag is compared with seed from the first year, kept as a control; the seed that does not transmit the characters of the "mother" beet is discarded.

The cycle of work was started in 1917; good quality commercial seed belonging to the best varieties was sown; at harvest time, the beets with the requisite qualities of foliage, shape and neck, were cleaned with a wooden spatula, numbered with steel tags, weighed with a spring balance and classified in order of weight. They were then bored with a gimlet scraper, the pulp obtained being used to estimate the sugar content by means of the polarimeter. The beets analysed are classed, according to their weight and sugar content, in four groups : — 1) family heads; 2) choice; 3) third pick; 4) rejected. The family heads were observed separately and replanted alone or in groups of 2, 4 or 6 beets belonging to the same variety or two different ones. At flowering time they are surrounded by frames covered with cloth to avoid hybridisation between adjacent groups (it is best to place the beets in the open air in a plantation, sufficiently far from any possibility of hybridisation, for the seed bearers, when placed under cloth during flowering produce less seed than when growing in the open air).

The sugar Beet Seed Commission was also entrusted with the duty of ascertaining how to increase the yield of sugar per unit area. Comparison of the yields for the 10 years 1904-1913 in the various regions of northern Europe shows that the climate has a great influence on the yield of sugar per acre. The sugar beet needs a great deal of water, which should be supplied very gradually. Soil worked deeply and of even tith and texture is more efficacious for storing up water. The results of the cultural tests depend in great part on the cultivation and the use of manures. The quality of the sugar beet seed depends on its germination capacity and on its selection brand. The germination capacity can be found in the laboratory but not so the selection brand; this can only be received with confidence if it gives good results and that is why it is so essential to produce seeds of a certain brand.

589 — **Researches on the Best Way for Preserving the Seed of the White Mulberry so as to maintain its Germinating Power, in Italy** (1). — ACQUA C., in the *Informazioni seriche*, Year VI, No. 5, pp. 47-49. Rome, March 5, 1919.

The seeds (which are really fruits, achenes) of the white mulberry are usually of low germinating capacity (50 to 60 % at the most) and, in addition have a short life, which is already diminished by the second year. For this

(1) See R., December, 1918, No. 1342 (Ed.)

reason it is worth while finding out the best way to preserve the seeds so that they will germinate well if they have to be kept one or two years.

In order to find out the action of cold, the author placed, in April, 1918 seed from the same sample (with a germination capacity of 55-60 % and which had been sent to him in January) in two gauze bags, one of which (control) was exposed to a normal temperature and the other placed in a cold store at 60C. until about the end of September. From then until December, the author did germination tests with both lots and found an average of 42 % for the seed kept in the cold store and 34 % for that kept at ordinary temperatures. But, on the other hand, another sample, sent to the author in January, 1918 then kept in a room with a southern exposure and heated during winter, had a 50 % germination capacity; in this case the useful factor seems to have been the dryness of the air rather than the cold.

In another experiment, to determine the influence of aeration, mulberry seed was kept in a cylindrical bag of cloth (measuring 70 cm. in circumference at 30 cm. in height) from April, 1918, to January 1919, without ever opening or shaking it; at the latter date, the author gathered the seed separately from the top and middle of the bag, and found that the former, which had been in continual contact with the air, had a germination capacity of 30 % against 23 % for the latter. Aeration is also favourable, therefore.

CONCLUSION. The maintenance of the germination capacity is favoured by a low temperature during summer, preserving during winter in a warm and, consequently, very dry place, and aeration. The best way is to "keep the seed at the natural temperature, in a dry place, with a southern exposure, so as to have as little damp as possible, to spread it in thin layers and stir it frequently"; this is the old method long used for preserving seeds in general.

CEREAL
AND
PULSE CROPS

590 - **Red Fife and White Fife wheats** - SAUNDERS, C. E., in the *Dominion Experiment Farms, Seasonal Hints* (East and British Columbia), No. 13, pp. 54. Ottawa, Ontario, March, 1919

The origin of "Red Fife" (1) wheat in Canada is well known, but that of "White Fife" is still obscure. However, it seems certain that the latter is a mutation from the former. The only appreciable difference is found in the colour of the bran: that of Red Fife is fairly dark reddish brown, while that of White Fife is pale yellow. A long comparative study of the two wheats has shown that they are nearly, if not absolutely, identical. Contrary to the common opinion, the grain of White Fife is not softer than that of Red Fife and it is neither inferior as regards bread-making nor better as regards yield.

As red wheats are preferred commercially, the author (Dominion Cereal-ist) advises that, in Canada, White Fife should be replaced by Red Fife, especially early Red Fife.

(1) See the article by L. H. NIWMANN, Wheat Production in Canada, in *R.*, July, 1917, pp. 961-967. Red Fife predominates in the wheat introduced into Europe under the name of "Manitoba", and DE VILMORIN proposes to replace the second name of less vague name by the more exact first one. See *R.*, April, No. 326. (*Ed.*)

591 - **Rosen Rye, A New Variety with a High Grain Yield Obtained by Selection at the Michigan Agricultural Station, U. S. A.** — SPRAGG, F. A., and NICOLSON, J. W., in *The Journal of Heredity*, Vol. IX, No. 8, pp. 375-378 + 3 Figs. Washington, December, 1918

This new variety, obtained by selecting rye from Russia, is distinguished from the local varieties by the following characters :

- 1) Short, strong straw.
- 2) High percentage of setting, in good years as much as 99 % (compared with approximately 50 % for the ordinary varieties).
- 3) Very developed grain, exceeding the glumelles.
- 4) Ears of the same length as those of the ordinary varieties, but much more compact and larger, with square sections.
- 5) As a result of the characters of the ear and grain, very high grain yield : — an average of 19.9 to 21.5 cwt. per acre, as compared with 7.2 and 7.9 cwt. for the ordinary varieties.

These qualities show that the cultivation of this variety should be extended as much as possible in order to substitute it for the local varieties. As rye, like all cross-fertilising species, is subject to hybridisation from natural crosses, the propagation fields must be isolated and most carefully controlled in order to prevent the new variety from degenerating rapidly. This is being done by the Michigan Crop Improvement Association in collaboration with the Michigan Agricultural Station, and farmers who undertake to produce and sell controlled seed guaranteed to contain 99% of seed of the Rosen type.

592 - **Rice Growing in the Dominican Republic** — MCLEAN, A. in *Commerce Reports*, No. 158, p. 153 Washington, D. C., 1917.

The cultivation of rice is among the most promising industries in the Dominican Republic. Rice might be properly termed the staple food of this country, as it is the largest single import, reaching in 1917 a record value as the following table of imports shows (kilo = 2.2046 pounds) ;

Year	Kg.	Value	Year	Kg	Value
1912	12 109 110	772 982	1915	11 748 67*	\$ 908 876
1913	13 002 935	736 751	1916	12 241 018	1 080 068
1914	8 755 991	435 776	1917	11 572 278	1 317 112

The growing of rice has only recently been started in the Republic, and the production does not yet fully supply the local market, much less leave a surplus for export. There are thousands of acres of land suitable for rice in the Dominican Republic, the prices of which range from \$ 5 to \$ 25, depending on its fertility and accessibility. With irrigation two crops of rice may be obtained a year. Labour is good and fairly plentiful. The prevailing wages for farm hands are 60 to 70 cents per day of 12 hours. Women are also employed at 30 to 40 cents a day, and it is said that their work is equal to the men's.

The rice that is produced is grown principally in the Provinces of Azua, la Vega, Santo Domingo, Pacificador, and Monte Cristi. In the last

named province it is grown by means of irrigation. Although there are no statistics available it is estimated that there are about 2 000 acres of rice under cultivation in the Dominican Republic.

The native rice is of inferior quality, owing to primitive methods of harvesting and milling. There are many broken grains, and the rice is not uniform in either size or firmness, nor is it polished. The mortar and pestle are still used to a great extent in husking and there are also many small hand mills in the rice-growing districts. There are only four modern mills in the entire country, although there will undoubtedly be more used as this industry is developed.

While the Dominican Republic may never become an exporter of rice, it should in time produce sufficient for its own consumption.

**FORAGE
CROPS,
MEADOWS
AND PASTURES**

593 - **Sudan Grass (*Sorghum exiguum*) in the South of France** — SCHREIBAU, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol V, No. 14, pp 460-464. Paris, April 9, 1919

The author describes the excellent results obtained by M. LIBES in the Gard district (France) when attempting to grow *Sorghum exiguum*, which was introduced into America in 1903 from the Egyptian Sudan under the name of Sudan grass (1). This grass appears to be really interesting, at any rate for the south of France.

As its origin is a warm region, Sudan grass should only be sown after the last spring frosts; 12 to 15 kg. of seed suffice per hectare; it should be sown in lines 40 to 60 cm. apart so that it can be hoed; if it is not hoed the lines can be 20 to 25 cm. apart.

Four chief characters show this plant to be worth the attention of farmers in the south of France: 1) great resistance to drought; 2) rapid growth (so much so that when sown close it chokes out weeds); 3) very high yields on irrigated, fertile soils; its yield in food material appears to exceed that of annual plants grown under the same conditions; 4) can be made into hay.

In the United States, Sudan grass has given the extraordinary crop of 20 000 kg. of hay per hectare (nearly 8 tons per acre). The author intends to study the possibilities of the plant for the north of France as well.

FIBRE CROPS

594 - **The First Cotton Growing Experiments in Fuehat, Bengasi.** — ZANON, VITO, in *L'Agricoltura coloniale*, Year XII, No. 6, pp 337-344 + Figs. Florence, December 31, 1918

Cotton-growing without irrigation in the Bengasi plain has to face climatic conditions (little rain, predominance of strong, dry winds) which, at first sight, seem unfavourable; on the other hand, it is not worth while growing it with irrigation, as greater profits can be obtained by using the water for other crops. But the author has seen very vigorous plants of arboresecent cotton (*Gossypium barbadense*) in several gardens in Bengasi and he has considered the possibility of exploiting the immense steppe of Bengasi by means of cotton-growing. The local seeds (thus already acclima-

(1) See R, July 1913, No. 799; R, Jan 1916, No. 42; R, May 1917, No. 431; R, October, 1917, No. 893. (Ed)

tised) as well as those of "Caravonica Wool" and "Boyd's Prolific" sent to the author from Sicily, only germinate in May, that is, when no reliance can be placed on the rains that give an impulse to growth so that the plant will afterwards be in a condition to resist the long period of drought and the winds; again the growth of the adult plant stops from December to May (flowering takes place in June).

The problem was to obtain small plants on the spot that would be lignified by May. But replanting has small chance of success at that period, and all that can be done is to sow in pots.

The author has found out how to make sowing easy and cheap by using old preserved food cans of a litre capacity; he removed the cover of the cans and cut the bottom all round save at one place left for an attachment; he filled them with earth and sowed the local cotton (*barbadense*) in August; he occasionally watered the plants and, in December, i. e., after the first rains, transplanted them in deep trenches 70 to 80 cm. deep and 1 to 2 metres apart. Transplanting is very easy as all that has to be done is to remove the bottoms of the cans, which only just hold together — having been cut as described above — and place the plants in position just as they are in the bottomless cans; the metal is quickly eaten away by rust and the plants are free in the soil. They are then left alone.

Even in the first year after transplanting the plants flower and bear fruit once. The operations of sowing and transplanting are considered by the author to be neither too expensive nor too tiring, since the cotton plant certainly lives more than 12 years in Bengasi.

As regards quality, the Bengasi *barbadense* cotton is quite equal to "Caravonica Wool" and it might be improved very much yet by means of selection.

595 - **Indo-Chinese Cotton** (1). — PRUDHOMME, E., in *L'Économie coloniale, Bulletin mensuel du Jardin Colonial*. Year III, New Series, No. 20, pp. 60-61. Paris, Sept. 4, Oct., 1918.

In a study that appeared in the *Bulletin du Jardin Colonial*, the author (Director of the "Jardin Colonial", at Nogent-sur-Marne, France) drew attention to the interest that cotton growing on those soils in Cambodia not subject to periodical inundations by the Mekong river or its tributaries might have for the French spinning industry (2).

The author points out that, up to the present, Indo-China is the French colony that exports most cotton. This crop is most developed in Cambodia and Annam, regions with a yearly exportation of lint and unginned cotton. Tonkin also furnishes small quantities of cotton, but the crop, being entirely absorbed by local needs, does not give rise to any external commerce.

The pre-war exportation statistics show, as will be seen from the appended Table, that, for the last 5 normal years 1909-1913 inclusive, the exports of Indo-Chinese cotton reached an average of over 3000 metric tons of lint per annum. The amount exported in 1913 was almost double that exported in 1909.

(1) See *R*, December, 1919, No. 1355 and *R*, January 1919, No. 46 (*Ed*)

(2) See *R*, January, 1919, No. 46. (*Ed*.)

Exportation of Indo-Chinese cotton (in metric tons).

Form in which exported	1909	1910	1911	1912	1913	Averages
Lint cotton	2 288	1 319	1 354	2 004	3 284	2 049.8
Unginned cotton (*) expressed as lint.	440	730	543	968	2 129	962
<i>Totals</i>	2 728	2 049	1 897	2 972	5 413	3 011.8

* The unginned cotton exported comes mostly from Annam. To express this cotton as lint, the quantity of cotton delivered for export was divided by 3, which corresponds to a yield of about 33 %. (*Author*)

596 **Chinese Experiments with American Cotton Seed.** MAYNARD, L. in *Commerce Reports*, No. 164, p. 165 Washington, D C, 1918

An augmented program of experimentation with American cotton seed in and about Shanghai has been laid out for 1918 by the Cotton Improvement Association of China. The organization is a newly-formed body of 400 men interested in the cotton-growing industry hereabouts and one which is specializing in the introduction of American cotton.

A consignment of 120 sacks of Georgia cotton seed of a variety which has given gratifying results in the past season has been just received. The seeds are to be distributed among the members of the association.

The consignment totals 2400 pounds of seed of the Cleveland Big Ball variety sufficient to plant 400 mow (a "mow" is approximately one fifth of an acre) of land and is expected to yield a return which will assure the planting of a very large area next year. Mr. Moh, a cotton spinner who started the Cotton Improvements Association of China, besides planting his 60-mow experiment station in Yangtzepoo, has opened a new station of 36 mow in Pootung to be devoted to the acclimatization of American cotton. His successes of the past seasons have convinced him of the superiority of this cotton over the native plant and of the entire feasibility of its successful introduction into China.

His work has given to Mr. MOH entire confidence in the future of American cotton here, a feeling shared by Mr. H. H. Jobson, the American cotton expert, who came to China to investigate for the Chinese Government. The results secured at Yangtzepoo station last year were gratifying. The season's crop spun consistently 32s and 42s. The usual return from Chinese cotton is 16s or 20s.

According to Mr. MOH, if attention is paid to the care of the seed there is no question but that American cotton can be successfully introduced to the country about Shanghai. There have been unsuccessful attempts in the past, but there were reasons for it. The crop was usually planted too late and the seed was not of the variety suited to local conditions. It was invariably obtained from Oklahoma or Texas, where very dry conditions prevail, and was thus entirely unadapted to the locality; whereas the seed from Georgia can be acclimatized in about three years.

The Chinese of the cotton industry have come to a realization of the necessity for improving the fibre of the native plant. It was with this in view that the Cotton Improvement Association was formed and plans laid for enlarging the field of experimentation in 1918, hoping to have a successful crop and to obtain seed for greatly increased planting next season, as it not advisable to introduce new seeds each year. The new experiment station in Pootung will be called the association station, and will be conducted under its auspices and for the benefit and instruction of the members.

There are further indications of an active interest in cotton improvement among Chinese officials.

597 - Textile Fibres Furnished by the Lotus in Italy. — See No. 601 of this Review

598 - Olive-Growing in Apulia, Italy. — BRIGANTI, G., in *L'Agricoltura italiana illustrata*, Year I, No. 1, pp. 32-57 + 13 Figs. Milan, January, 1919.

OIL-YIELDING
PLANTS

Apulia, and especially the provinces of Bari and Lecce, is the largest and most active olive-growing region (1) in the south of Italy.

Out of a total of 588 400 hectares of specialised olive orchards in Italy, about $\frac{3}{5}$, or 312 800 hectares, belong to Apulia; this also includes a little less than 200 000 hectares of olive orchards with intercalated crops, against 1 720 000 hectares for the whole of Italy.

The oil-extractors in Apulia work each year an average of over 2 million quintals of olives; however, this amount varies a great deal from year to year; thus, in 1915, there was a minimum of 1 million quintals (national production: 9 300 000 quintals) and, in 1916, a maximum of 6 848 000 quintals (national production just under 13 million quintals), i. e., the annual production of the olive orchards in Apulia is between $\frac{1}{5}$ and $\frac{1}{2}$ of the production of all the olive orchards in Italy, and is, on an average, a little more than $\frac{1}{5}$. The value of the crop varies between 25 and more than 170 million lire.

In Apulia, as in the rest of Italy, olive growing is sensibly declining. The years of abundant production alternate with periods of poor crops lasting 3 to 10 years. This is due to many causes: — in the first place, too great age of numerous orchards; agamic reproduction by suckers often taken off old plants; bad spring weather; prolonged drought, sometimes lasting three-quarters of the year; unsuitable manuring, pruning and cultivation; annual invasion either of the olive fly (*Dacus oleae*), the olive tineia (*Prays oleellus*), *Rhynchites cribripennis*, or of all three of these very injurious insects at once; infections by vegetable parasites.

The phenomenon that is repeated each year with varying intensity in the olive-orchards of all the regions and, to a higher degree, in those of Apulia, is the very abundant flowering of the trees followed very often by a small and sometimes very small crop. There is a high percentage of ab-

(1) See the article by Prof. F. BRACCI, The Present State of Olive-Growing in Italy, in R. October 1913, pp. 1406-1502 (Ed)

normal flowers, in which the female organ aborts when the flowers open; with certain varieties, and still more with certain environmental conditions, the percentage remains lower than 50%, while, in other cases, it even reaches 98%. A proportion of 20% of normally developed and fertilised flowers would be enough to assure an abundant crop but many of the flowers that are of normal development at the moment of anthesis (sometimes 80 and even 90%) are subject to a progressive diminution of their physiological activity (Petri) (1) particularly favoured by a lack of nutrition of the plant and by persistent drought.

In Italy, the average unit production of olives, according to the official statistics, is only 8 quintals per specialised hectare. The value of the national production is, on an average, 250 million *lire*. The author thinks that were suitable technical methods employed, this figure could be easily doubled. The Italian preserved olive industry (2) might become of much more importance than it is at present.

599 - *Elaeis Terema* a New Oil Palm. — *Bulletin de l'Office colonial* (according to the *Deutsche Kolonialzeitung*) Year XXII, No 133, p 28 Paris-Mulun, January, 1919

A very good new oil palm has been discovered in the Cameroons. It is *Elaeis Terema*, whose oily nut is surrounded by a pulp so rich in oil that the yield is almost double that of *Lisombe* (3), a variety which has so far been considered the best for planters.

Before recommending that this fairly rare variety should be cultivated, the German administration wished to wait for the result of the experiments carried out at the Victoria Experiment Garden.

600 - *Hevea* in the Belgian Congo. — DE BAYAT YVON in the *Bulletin agricole du Congo Belge*, Vol IX, Nos 14, pp 78-91 + 4 Figs. London (during the war), March-December, 1918

Report on the hevea plantation at Yangambi (near Stanleyville) by the author (sent on a mission), who is the manager of some hevea plantations in Malasia. The mission, which lasted from November 16, 1917 to February 14, 1918, had the object of organising an experiment on the exploitation of sufficiently developed heveas, based on the methods employed in the hevea plantations in the Far East.

The plantation was started in 1911; 11411 trees were planted in the first year on 46.6 hectares; in 1913, 26 750 trees were planted on 132 hec-

(1) See *R*, July, 1913, No 876, Jan., 1915, No 108, May, 1917, No 438 (*Ed*)

(2) Spain produces annually more than 400 000 quintals of preserved green olives and exports more than half of this, more than 120 000 to 130 000 quintals going to the United States. The "Spanish olive" commonly grown in the province of Bari and particularly in the territory of Andria has a large stone and somewhat woody flesh, the best Italian table olive is the "Ascolana" variety, which closely resembles that of Seville, which is so much appreciated (GAETANO BRIGANTI *Per alcune nostre industrie agrarie* [In support of some of our agricultural industries], in *La Propaganda agricola e l'Agricoltura pugliese*, Series II, Year X, No 13, pp 145-148 Bari, July 15, 1918 (*Ed*))

(3) Variety of *Elaeis nigrescens*; see *R*, Sept., 1918, No 986 (*Ed*)

tares; the plantation therefore includes 38191 trees planted on 178.6 hectares. The trees are planted 7 metres apart in squares, giving 204 trees per hectare.

The author deals with labour, the general condition of the plantations as regards maintenance and growth, tapping, cropping and yields, treatment of the product, intercalary crops (coffee, *Elacis*), the diseases and pests of hevea (*Fomes semitostus* and dieback [*Thyridaria tarda*], termites), drainage, buildings, and rainfall.

The reputation of hevea rubber from certain plantations in the Congo is not yet established; it may even be said that it is not well thought of. The author says that this opinion is not true.

A hevea plantation in selected soil with a favourable climate, with a way for exporting the product, conditions that are to be found at Yangambi, for example, can succeed and be worked commercially just as much as a similar plantation in Malaya, Java or Sumatra.

To obtain this result, the methods of management and manufacture of the product employed in Malaya must be adopted. The same pecuniary sacrifices as regards clearing, upkeep and the acquisition of all the modern machinery necessary for obtaining a perfect product must be consented to. The European markets are very exigent as regards plantation rubber, and, in order to obtain a good reputation, all these exigences must be satisfied as is done in the Far East. Labour is much cheaper in the Congo than anywhere in the Far East and, moreover, the experiments at Yangambi have proved that the local labour possesses the requisite aptitude for the rational exploitation of a hevea plantation. However, to be successful, permanent workmen, kept under a real contract must be had, as tapping the hevea is a delicate task that should be carried out regularly and which requires a long apprenticeship; continual changing of the labourers would be injurious. The solution of this question is not impossible and, when it is solved, the commercial future of hevea in the Congo will also be solved.

601 - **The Future of Tea in Indo China** (1) CHALOT, C, in *L'Économie coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year III, No. 23, pp. 152-162 Paris, March-April, 1919

STIMULANT,
NARCOTIC AND
MEDICINAL
PLANTS

The author's study forms a useful supplement to the report presented by M. P. EBERHARDT in 1918 to the Congress of Colonial Agriculture (2).

With a little effort, almost all the tea required by France could be supplied by Indo-China.

Before the war, France consumed about 1250 metric tons of black tea every year; in 1915, 1916 and 1917, the consumption was nearly doubled reaching 2500 metric tons in round figures. To this should be added the black and green tea consumed in North Africa and French West Africa. The pre-war figures are given below:—

(1) Regarding Indo-Chinese tea, see R, Nov. 1918, No. 1243 and April 1919, No. 467.

(2) See R, Nov. 1918, No. 1243

Green teas.		Black teas.	
Morocco	2385 metric tons	France	1250 metric tons
Tunis	300 " "	African colonies	200 " "
Algeria	280 " "		
Senegal	85 " "		
Total	3050 " "	Total	1450 " "
Grand total	4500 metric tons		

Here, then, is an advantageous market open to Indo-Chinese tea, without counting that open to the tea waste for the extraction of caffeine (1).

If the odd thousand tons that Indo-China is obliged to import each year from China are added to these figures, a total of at least 5500 metric tons is obtained that the country could produce without any fear of over-production.

Indo-China could arrive at this total fairly rapidly, as it would only represent about 10 times its pre-war production which, besides, had increased from 35 metric tons in 1898 to 489 metric tons in 1914 (the exports reached the maximum of 962 metric tons in 1915). About $\frac{1}{4}$ of the exportation comes from Tonkin.

The production has been greatly encouraged by the complete freedom from duties in France enjoyed by Indo-Chinese tea since January 1, 1914, and which represents a premium for it of 2.08 francs per kilo.

Indo-Chinese tea has been criticised for a certain sourness, a slightly bitter taste and a lack of aroma. These defects can easily be corrected:— 1) by suitable cultivation and pruning; 2) by gathering the young leaves only, instead of collecting all the mature leaves without distinction; 3) by a good fermentation, which decreases the tannin content; 4) by the well-known methods for decreasing the thein content and augmenting the aroma.

The author gives analyses of Indo-Chinese teas made to compare with analyses of Ceylon, China, Java, Indian and Caucasian teas. The analyses were made by M. L. RIGOTARD at the "Jardin Colonial".

After gathering, the leaves should be properly sorted, so that the different commercial grades — fine, medium and large leaves — should consist of the youngest leaves starting with those at the end of the branch and going down as far as the fifth for example.

Proper machinery should be substituted in the operations — fading, rolling, sifting and drying — hitherto carried out by hand.

It would be useful to create licences for tea preparers, as is done in Tahiti.

In conclusion, expert examination of the tea, when about to be exported, would, it appears, give good results by refusing to stamp any teas that do not possess the commercial qualities necessary for exportation.

(1) France needs about 8000 kg. of caffeine, of which 2000 kg. are exported in various forms. Supposing that Indo-Chinese tea waste gives an industrial yield of 2 % of caffeine, 400 000 kg. of waste from its large Asiatic colony could be utilised in France. As regards this, Indo-Chinese tea has a higher caffeine content than that from other sources, it is therefore highly suitable for the extraction of this alkaloid (*Author*).

- 602 - **Tea from the Caucasus.** — *L'Agronomie coloniale, Bulletin mensuel du Jardin colonial*, New Series, Year III, No. 22, pp. 125-216. Paris, January-February, 1919.

A brief summary of the study by M. V. THIEBAUT (1), followed by the results of an analysis of tea from the Caucasus carried out in the French "Jardin Colonial" by M. R. RIGOTARD. The percentage results are: — Water, 9.15; Nitrogen, 4.20 (nitrogenous matter $4.20 \times 6.25 = 26.25$); Tannin, 5.17; Caffein, 1.60; Fats, 0.35. This tea is remarkable for its low tannin content and small caffein content.

- 603 - **Medicinal Plants in the Italian State Forests.** — FIORI, A, in *L'Alpe, Rivista Forestale Italiana*, Series II, Year VI, Nos 1-2, pp. 20-24. Florence, Jan.-Feb., 1919

The author has been given the task by the General Direction of the Italian State Forests of ascertaining the richness in medicinal plants of the unalienable State forests. To do this, the author visited, during the summers of 1917 and 1918, the forests of Consiglio (Venetia), Boscolungo and Casentino (Tuscany), Monticello (Abruzzi), Gallipoli-Cognato (Apulia), and Camere Chiuse (Sila, Abruzzi); the author had studied the flora of the forests of Vallombrosa and Follonica (Tuscany), and Umbra-Jacotenente (Gargano Promontory, Apulia) previously. The author shows, by means of a table, for each of the above-mentioned forests (except for that of Follonica, which is very poor in medicinal plants), the absence, presence, or abundance of 48 medicinal species. It appears that arnica (*Arnica montana*) could be gathered in great quantities in the forest of Consiglio; valerian (*Valeriana officinalis*) is abundant in the same forest and particularly in that of Sila; hemlock (*Conium maculatum*) in those of Monticchio and Gallipoli-Cognato; male-fern (*Polystichum Filix-mas*) in all the forests of the zone of the beech and fir; the burdock (*Arctium Lappa*); the common elder (*Sambucus nigra*), the St. John's-wort (*Hypericum perforatum*); the germander (*Teucrium Chamaedrys*), the raspberry (*Rubus Idaeus*), the mallow (*Malva sylvestris*), the thyme (*Thymus Serpyllum*); the woodruff (*Asperula odorata*) the medicinal speedwell (*Veronica officinalis*); the great mullein (*Verbascum Thapsus*) and many other species occur in nearly all the State forests; the deadly nightshade could be gathered in the forests of Consiglio, Boscolungo, Vallombrosa, Camaldoli, Casentino, Umbra-Jacotenente, Monticchio and Sila.

Tests made by the author show that the deadly nightshade (belladonna) and still more the fox-glove (*Digitalis*) can be easily propagated from seed in the forests, without actually being cultivated.

- 604 - **The Cultivation of the Lotus (*Nelumbium speciosum*) in Italy.** — BERTARELLI, S., in *L'Agricoltura italiana*, Year 1, No. 2, p. 65. Milan, February 2, 1919

The lotus, introduced as an ornamental plant into Italy, has become perfectly acclimatised there and develops luxuriantly even when completely abandoned. The author suggests that it should be cultivated for its rhiz-

(1) See R., March, 1919, No. 323 (Ed.)

omes, from which excellent starch can be extracted, in pools that yield no revenue. In the East, this starch is used for making alimentary pastes, and the rhizomes, as well as the small fruits of the lotus, are eaten directly. The author has found that fine silky textile fibres can be obtained from the stems and flowers of this plant either by mechanical treatment or by maceration.

**FRUIT
GROWING**

605 — *Anona Cherimolia* in Italy. — SAVAST NO. 1., in *L'Agricoltura italiana illustrata* Year 1, No. 2, pp 73-79, 8 Figs. Milan, February 25, 1910.

Anona Cherimolia was introduced over a century ago into Italy, but it has spread very little up to the present. In a few localities in Calabria and Sicily it has become acclimatised well, especially in the neighbourhood of Reggio Calabria. Its acclimatisation is due to being continuously reproduced by seed, for "a species becomes acclimatised in a region by sowing its seeds, not by planting cuttings". In the above-mentioned region, the tree is rarely more than 26 ft. high; the branches at the summit are excessively elongated and protrude from the crown, the lateral branches are excessively pendent; the wood is tender, splitting easily; there are no suckers either from the root or stock, which is a disadvantage as regards cultivation; the leaves begin to fall in April, when the new leaves and flowers appear; growth is practically continuous, with a slackening-up in January-February and, if the tree is not irrigated, occasionally towards August. It flowers in April-May, the fruit forming in September-December, but not in large quantities (these are ungrafted plants); a good plant, well cultivated, produces an average of from 44 to 66 lb. of fruit each year. The size and shape of the fruit varies, sometimes even on the same tree. The crop may be calculated as: — 10% of large fruit (up to 350 gm.); 40% of medium-sized fruit (about 140 gm.); 50% of small fruit. About $\frac{2}{3}$ to $\frac{3}{4}$ of the fruit is eatable. A seed weighs 2.62 gm. on an average. According to experiments made by the author at Naples the seeds retain their power of germination for 6 months. The analysis of *Anona* fruit from Reggio made by M. CURIONI gave (in %): water 73.74; sugars 11.86; acids, 0.858; fibres, 4.08; albuminoids, 2.80; fat, 0.35.

This *Anona* which, where grown in Italy, occupies the northern sub-region of cultivation of the species, must be selected so as to obtain:— early fruit (so as to avoid freezing in winter); complete or almost complete, absence of seeds; resistance of the tree to low winter temperatures. In the territory of Reggio, there are trees that possess these characters, so that a variety could be fixed and propagated afterwards by grafting.

The plant is sown in a nursery; after 2 years it is transplanted and, 2 to 4 years later, it is planted in its proper place. The author advises spring grafting: the adult trees should be fairly heavily pruned to encourage the formation of new wood. Grafting is best done in the nursery at the age of 1 or 2 years. Cultivation is the same as for lemons and bergamots; in addition the soil should be partially drained.

In southern Italy, *Anona cherimolia* is acclimatised and adapted to the cultural conditions of that region; it is worth while making use of so much

work, by cultivating the plant in future on real commercial lines. The aim should be to produce a luxury fruit which, as a "tropical rarity" would command good prices, but would never in any way become an article of general consumption.

606 - "Chinin" a New Variety of Avocado from Mexico. — IRÉ, G., in *L'Agronomie coloniale*, New Series, Year III, No. 20, pp. 42-44+3 Figs. Paris, September-October, 1918.

Amongst the numerous varieties of Avocado or alligator pear (*Persea gratissima* Gaertn.) grown in the State of Tabasco, there is one that is so clearly distinct from the ordinary type with smooth fruit that it should be considered as a new one. In appearance the plant is little different from the other "aguacates", but the young branches and the lower surface of the leaves are strongly hairy. The fruit is entirely distinct and, in addition, is very variable as regards appearance and colour.

The fruit of this variety (including 4 different types), known as "chinin" are distinguished from the avocado: 1) by their wrinkled skin; 2) by the nature of the endocarp, always thick and resistant; 3) by the texture and savour of their pulp. Their biological characters and cultural requirements have not yet been studied in detail.

The fruit is much liked in Mexico and deserves the favour it enjoys

607 Modifications to be Introduced into the Topography of Vineyards on Slopes. — LARUE, P., in *Le Progrès agricole et viticole*, West-Central Edition, Year XI, No. 15, pp. 345-351+1 Photograph. Villefranche (Rhône), April 13, 1919.

VINE GROWING

Previously vines were planted on the flanks of slopes according to the line of greatest slope, which facilitated digging when mounting and avoided difficulties of nearness due to differences of level. The lines were cut by horizontal ditches and the soil was patiently carried up again during winter. These operations were all right in their time; the cost of labour has increased considerably and, in general, one can only keep on farming when all work requiring strength or continuous effort is carried out by teams or machinery.

Ploughing in the direction of the slope has serious disadvantages; the result is that ploughing can only be done going down, thus hastening the slipping of the surface soil. Again, worked soil is more easily acted on by atmospheric agencies and water flowing down the furrows leads to erosion, thus filling up the down ditch and depriving the slope of fine soil.

The author suggests the use of cultivation in terraces or half-terraces, by planting the vines on lines of the same level, so that ploughing will be horizontal. He shows how to form terraces, giving a special description of the method used in the Vosges.

Work is going to be restarted with energy in those countries that have suffered from the war; and it is a favourable moment for changing the topography of vineyards on slopes by means of half-terraces, so that ploughing could be carried out on the same level, leading to a decrease of the cost and an increase of the fertility. The method cannot be applied to too stony soils that could be planted with timber if their cultivation is too expensive.

The author also deals with re-memberment of vineyards and the provision of paths or roads for working them.

FORESTRY

608 - **Research Program of the Swedish Forestry Experiment Station for the Triennial Period 1918-1920.** — *Meddelanden från Statens Skogs försöksanstalt*, Pt. 15, pp. 117-191 + 5 Figs. Stockholm, 1918

In sequence to the program of the triennial period 1915-1917 (1), the Swedish Forestry Experiment Station is continuing the researches begun on the *regeneration of forests* (seeds, special methods for helping natural regeneration, methods of cultivation).

As regards the *development of plantations* the Institute continues to deal with them as far as their revenue is concerned, particularly with the idea of establishing the coefficient of shape for various forest trees especially *Pinus sylvestris*, and obtaining the allometrical tables for *P. sylvestris* and the birch after complete thinning at the bottom. The oak will also be studied in such a way as to make a preliminary enquiry into the development of plantations of this tree, as well as the duration of growth of the commonest forest trees.

In the same order of researches, as regards the management of plantations the existing plots will be re-examined and, if necessary, thinned. New plots will be laid down to determine the effect of thinning, especially on *Pinus sylvestris* and the birch in Norrland, and eventually in the mixed stands of conifers leaving, as far as possible, plots intact to act as controls.

The researches on the *diseases of forest plants* are being continued, regarding the study of the different *sorts of forest trees* and the utilisation of exotic species, the study of the varieties of spruce and *Pinus sylvestris*, that of the German spruce seeds, as well as those on the larch and fir are being continued. As regards the researches on *forest soils*, while continuing those on the different types of soil, on heaths, on damp forest soils the Institute will also study the freezing of forest soils from the standpoint of practical forestry; as regards the researches on the transformation of peat beds into forest soils, it is especially drainage in relation to nitrogen transformation that will be studied. Researches on the influence of lower animal life on the nature of the soil in land submitted or not to cutting will be undertaken.

In conclusion, the foresters will continue to elaborate their reports on the state of the production of forest seeds.

609 - **The Stone Pine (*Pinus Pinea*), in Italy.** — COTTA, A., in *L'Italia agricola*, Year V Nos. 1 and 3, pp. 10-16, 70-80 + 14 Figs + 1 Coloured Plate. Piacenza, January 15 and March 15, 1919

The zone of diffusion of the stone pine, which, perhaps, originally came from Crete, forms an ellipse whose long axis stretches from Asia Minor to the Canaries and whose short axis extends from Provence to Algeria. The most extensive woods formed by it occur along all the southern shores of

(1) See R, 1916, No 765 (Ed)

Portugal, in Andalusia, and in Old Castille; in Italy it forms the famous pine woods of Tombolo near Pisa and Migliarino near Ravenna. It usually lives from 200 to 250 years (some authors say 500); and it reaches over 80 ft. in height and from 3 to 5 ft in diameter.

Its characteristic root system, formed of a strong tap-root going deep into the soil and a certain number of lateral roots that radiate out horizontally and send out occasionally smaller secondary tap-roots, makes the trees very resistant to wind and very suitable for fixing the moving sands of the sea-shore. However, in shallow soils or in those with fresh water at a slight depth, the tap roots are reduced and the whole system loses much of its resistance to the wind. Its zone is that of the *lauretum*; extended up to the *castanetum*, it runs the risk of being killed by severe winter frosts to which it is very sensitive. If it is in damp soil, at any rate in its depth, it is not very exigent as regards atmospheric moisture. It is not very exacting as to soil, but calcareous soils do not suit it, as long as they are not sufficiently damp, and it has an absolute aversion for swamps. It resists marine salinity well.

It is above all a light loving tree; it can only withstand slight shade for 3 or 4 years and can live when grown close together for 25 or 30 years, but it must then be thinned in such a way that the 50 or 60 year old trees are completely isolated. At first its growth is rather rapid, but it soon slows down. For this reason it cannot furnish a large quantity of wood. The general forest guard SALINA reckons that the Ravenna pine forest furnishes 300 cubic metres of wood per hectare at 80 years, and MM. BIONDI and RIGHINI calculate that the pines at San Rossore furnish, at 90-95 years, 235 cubic metres of firewood and 60 cubic metres of timber per hectare; to these the products from thinning should be added.

The specific gravity of the green wood is about 0.895 and that of the dry wood 0.520 to 0.800, on an average 0.660. This wood is used by the navy as well as for making pavements, beams, etc.

Plantation is done as much from seed (usually preferred) as by planting (for the most difficult replanting work). The finest and most regular cones are chosen for preparing the seed (rejecting the early ones, which usually give an empty seed) and placed on racks to make them open, taking care to remove them at night and protect them from damp, or in sheds with a good exposure to the sun; they are turned from time to time to make the seed come away. The seeds are then resorted. The germination power of seed from the previous year is much reduced.

The best time for sowing is spring in central Italy and autumn in southern Italy (so that the young plants will not be overtaken by drought). When sowing on prepared soil, the seed is broadcasted (3 to 4 quintals per hectare); when sown in lines, the seed is placed in furrows, 2 or 3 to every 10-15 cm; if sowing on small plots the seed is hand-sown; the seeds are covered with 4 to 5 cm. of soil with a harrow or rake. In places where the soil is not prepared, as in sands or gravels, etc, the seed is placed in holes. In bare places where the young pines require protection from frost by means

of plants of more rapid growth (heath, broom), the seeds of these plants are sown with those of the pine.

The stone pine requires much attention: thinning the seedbeds in the 3rd or 4th year, followed by other thinnings at first near together than farther apart, every 5 - 6 - 7-8 - 10 years; each thinning should be accompanied by the lopping of the plants left in the soil, and care should be taken not to form gaps; at the 3rd thinning, from 400 to 500 plants per hectare are left; at the fourth, from 200 to 250; at the 5th and last, from 100 to 120. When thinning the wood, an underwood is formed that is utilised every 5 or 6 years for the collection of the twigs and every 10 or 12 years for the young trunks (ilex, oak, etc.) A pine wood with a thick underwood of ilex is very suitable from the economic point of view, but it requires great care and skill.

Harvesting begins at about the 20th year and is continued throughout the winter, save when intense cold makes the branches brittle. It is done by hand or by means of a pole fitted with a hook. The cones are taken to the barn and placed in furrows where they are left till they begin to open (April-May); the subsequent operations are done by a machine nowadays; a thresher separates the seeds from the bulky parts of the strobile; the seeds mixed with scales pass into a circular sieve and then into a fan, after which they are bagged and sent to the factory, where they are shelled.

A cubic metre of cones, containing from 1800 to 2000, weighs from 600 to 700 kg., and yields an average of 150 to 200 litres of unshelled seeds, i.e., 105 to 136 kg. when shelled. According to experiments carried out by M. M. BIONDI and RIGHINI at San Rossore, a pine wood yields, in a period of 20 to 30 years, about 5 cubic metres of cones, i.e. 30 to 35 quintals per hectare; from 30 to 40 years, 9 cubic metres, or 54 to 73 quintals; from 40 to 80 years, 20 cu. metres, or 120 to 140 quintals; from 80 to 95 years, the yield decreases to 6 cu. metres or 36 to 42 quintals. In the province of Pisa, 8 francs a quintal are now paid for the cones, still on the tree; the buyer has all the cost of harvesting, transport, etc., at his charge. From these prices, the revenue is from 240 to 1120 francs per hectare per year. In the State forest Cecina, 70 hectares of pine-forest, already advanced in age, were rented out at 23 800 francs a year, or 340 francs per hectare. These yields are very high for sandy soils, in which no other crop can be grown.

At 80-90 years, i.e., in mature pine woods, at least 120 trees per hectare and 2 cu. metres of wood per tree can be counted on. Before the war this wood sold at 25 to 30 francs per cubic metre; at present it is worth 200 francs per cubic metre.

The stone pine has not many enemies, but it cannot be said to be hardy. Among the insects that cause it most damage are: — the "pine caterpillar" (*Cnethocampa pityocampa*), which destroys the needles and produces a state of weakness that facilitates the attacks of other insects, such as *Myelophilus* (*Hylesinus*) *piniperda* and *Hylastes ater*. These, as larvae, bore numerous galleries at the base of the trunks; at the adult state, they feed on

the pith of the young branches of that year. When the pine forest is suffering from any cause (frost, drought, invasion of "pine caterpillars" etc.), the same or the following year the bostrychids of this pine develop to such an extent as to threaten the existence of the pine wood. Among vertebrate animals, the great woodpecker, the green woodpecker, and the dormouse are very fond of pine nuts. Where there is a warren, the rabbits damage the roots by digging numerous passages in the soil.

In low-lying, permanently damp localities, the Polypori *Trametes Pini* and *T. radiciperda* are often found; the former attacks the median part of the trunk, the latter the base of the trunk and the roots, and both cause "red rot", dry-up the tree and render the wood valueless. Another fungus attacks the nut, producing the disease known in Italy as "pine pagliose" (*Sphaeropsis necatrix*) (1). In some parts of San Rossore, 20 % of the strobiles were attacked by this disease.

610 - **The Eucalyptus in the Reconstitution of the Forestal Patrimony of Sardinia.**

— BLANDINI, F., in *L'Alpe, Rivista Forestale Italiana*, Series II, Year VI, Nos 1-2, pp 20-21, Florence, January-February, 1919

In Sardinia the provision of wood for pit props for the mines is of great importance. The wood work consists of "legs" (trunks or branches 8 ft. 3 in. high and 6 in. thick at the tip), "hats" (small logs; pieces having a diameter about the same as the previous ones, but only 5 ft. long) and "sticks" (flexible rods used for making a kind of wicker-work on the roof and walls of the gallery). Two "legs" and a "hat" make a frame.

The wood formerly preferred for mines was chestnut, which is that most resistant to rot; acacia, pine, oak and poplar have also been used; the latter is the least resistant to rot. For some years now, eucalyptus has been successfully used in the Gennamari-Ingurtosu mine, where frames made of this wood are still in good condition after 15 years. It is for this reason that the management has grown eucalyptus in the gorges that separate the schist or granite heights of the hill zone of Gennamari and Ingurtosu. From 1912-1913 to 1917-1918, 1227 200 eucalyptus trees were planted, a large part being intended for the mine. The species grown are *Eucalyptus Globulus*, *E. resinifera* and *E. rostrata*; the first species has given the best results because it grows quicker and straighter than the others.

About 30 years ago the Royal State Railways laid down plantations of eucalyptus in Sardinia that reached enormous dimensions and furnished excellent sleepers. The eucalyptus can furnish firewood and also (especially *E. Globulus*) provide material for distilling the oil from the leaves. The author suggests that the reafforestation of Sardinia should be carried out by laying down large plantations of eucalyptus.

611 - **The Productivity of Aspen in Sweden.** — SCHOTT, G., in the *Meddelanden från Statens Skogsförsköningstält*, Pt. 13-14, pp 1205-1219 + 5 Figs + Bibliography of 12 Publications, Stockholm 1917

The Sylvicultural, Section of the Swedish State Forestry Experiment Station, which mainly studies the yield of the woods and the types of stand

(1) See R., July 1916, No 810, (Ed.)

in Sweden, had included, in its program of work for 1915-1917, the establishment of aspen plantations that would serve as an example. This is mostly due to the fact that the war, by preventing the usual importation of aspen wood from Russia, has made its production a matter of interest to Sweden, owing to the necessity of remedying the shortage of this wood, which is used for making matches, due to the forced cutting of the national aspens. For this reason it is important to know the yield it can give and the best time for regenerating aspen in Sweden.

The experiments were carried out on seven plots. Although the resulting data are not complete, it can be deduced that there are two distinct classes of productivity, the first of which belongs to the best type of forest soil. It was found in this way that there are several varieties of aspen: one which thick and another with thin bark. For the first class of productivity, it can be calculated that 50 years are required in Sweden to produce about 200 cubic metres of perfect wood per hectare, with an average diameter of 20.5 cm.; for the second class the corresponding figures are 150 cubic metres and 18 cm.; the two classes yield 40 and 20 % of match wood respectively, that is, wood measuring over 18 cm. in diameter. At the 1917 prices, the best soil in Sweden brings in, with 50 year old stands, about 5555 francs (at par) per hectare, provided the wood is not heavily attacked with rot.

The author concludes that aspen is a valuable tree, worth being well managed in the best soils of Sweden. The point is not to neglect the aspens that grow wild in suitable soils and the attention they require consists chiefly in thinning them while they are young, then pruning and thinning them every 5 years.

Experiments on the direct cultivation of the aspen in good, slightly damp soil should also be carried out.

612 - The "Filao" (*Casuarina* spp), a Tree of Interest for the Reafforestation of certain Regions in Senegal. — ADAM, J., in the *Journal d'Agriculture pratique*, Year LXXXIII, New Series, Vol XXXII, No 9, pp 177-179 Paris, April 3, 1910

France has enormous forest resources in her colonies, particularly in Indo-China, Madagascar, the Ivory Coast and Guiana. Owing to the distant situation of these colonies and the difficulty of transport, it would be advisable for France to obtain her timber in colonies near to and which, with less natural forests than the previous ones, could be rapidly rewooded.

From this point of view, Senegal is particularly worthy of attention. A region of this country, where there are numerous sites that might be suitable for this purpose, is that known as "Niyyes", a zone of damp, low-lying ground forming chains along the coast between Dakar and Saint-Louis and carrying occasional tufts of vegetation consisting of oil-palms and large trees amongst which *Ficus* dominates. In these depressions, protected from strong sea breezes by high sand dunes and to a large degree stripped of their covering of vegetation by the vandalism of man, the cultivation of various bushy plants would have an excellent chance of success. A tree used for replanting, the "filao" — a large tree belonging

to the genus *Casuarina* and resembling the pines and firs in shape, while its leaves are like horsetails — on account of the little attention it requires and its very rapid growth, could be used in undertakings that might be very profitable.

The filao has very hard, wiry wood, very little attacked by insects (it is specially resistant to termites), very resistant to water and atmospheric conditions, and suitable, generally speaking, for all the uses to which oak is put. It is, in addition, one of the best heating woods.

The exploitation of the trees, planted at distances of 1 metre apart, might begin in the 3rd or 4th. year by carrying out a sort of thinning each year. At first the trees will yield poles, that will be required by the natives to build their houses and for other purposes; later there would be telegraph poles, masts and timber mostly suitable for frame work.

613 - Report of the Activity of the "Unión resinera Española" for the Financial Year 1917-1918. — *Revista de Montes*, Year XLII, No. 1001, pp. 668-670. Madrid, 1918 (1)

The report first remarks on the serious difficulties and the abnormal state of the market caused by the war and by the climatic conditions at the beginning of the working year 1917-1918, which were very unfavourable to the production of resin. This, together with the loss of time by the workers in the mountains, has led to a deficit of 250 gm. per tree, giving a decrease of about 11.50 % compared with the yield from the previous period. This diminution of the raw material is all the more regrettable because it is accompanied by a reduction of the coefficient of yield of oil of turpentine, though compensated by the greater profit given by the dry product owing to the increased price of resin.

Below a Table shows the resinous products obtained or bought by the "Unión Resinera Española" during the 5 years 1913-1917:

	1913	1914	1915	1916	1917
Oil of turpentine	5 695 051 kg	2 031 456 kg	4 501 281 kg	5 670 763 kg	4 414 491 kg.
Resins	14 958 883	15 642 812	17 153 998	14 273 563	17 869 670
Various. . . .	51 365	37 955	34 432	35 647	71 635
Totals. . .	20 705 299 kg.	17 112 223 kg.	21 692 711 kg	19 979 973 kg	22 355 796 kg.

In this report attention is drawn to a disadvantage of increasing gravity which threatens forest economy in Spain. During the period 1917-18, 83 505 pines were destroyed by fire, 27 843 being on the property of the "Unión Resinera" and the rest in public forest farmed by the society. There is reason to suspect that these fires, or at any rate most of them, were intentional. The incendiaries probably did not realise the damage they were doing and it may be that they are more ignorant than wicked. This is why the report shows the need in Spain for intense propaganda work in favour of forestry and states that the proprietors of public and private woods

(1) See R., 1917, No. 1012. (Ed.)

blood) and infection experiments by intravenous injections and by direct contact.

It is shown that infectious anaemia of the horse is a septicaemia *sui generis* that the healthy horse can contract by intravenous injections. The etiology of the disease is still obscure. It still remains to be settled whether the infectious anaemia that was so widespread on the east front of military operations in 1917 and 1918 was the same as that observed in the west and in France, America and Japan. Observations made in the last two countries assign a part in the infection to tabanids and stomoxys; the infectious anaemia in the west (France, Alsace-Lorraine and the Rhenish provinces) is distinguished by its highly contagious character in the stables and is apparently due to an ultramicroscopic virus.

The results of the author's researches seem to destroy the hypothesis that the disease observed in the western regions is one and the same and also the hypothesis of an eventual relationship between the presence of larvae of *Gastrophilus* ("Gastruslarven") and the disease.

The infectious anaemia of the horse is not related in any way with the pernicious anaemia of man. The diagnosis of the disease is extremely difficult; according to the author, the only sure way of diagnosing it consists in intravenous injections in experimental horses. Differential diagnosis is also very difficult: the term "infectious anaemia" is often used for different secondary anaemias in no way related to true infectious anaemia. Horses suffering from mange, glanders, intestinal catarrh, infection with helminths, etc. are often stated to be suffering from the disease in question.

617 - **Haemoglobinuric Bilious Fever of Cattle, in Algeria.** — SERGENT, ED. and LHÉRITIER, A., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 2, pp. 108-120 + 3 Tables Paris, February, 1919.

In the first rank of the diseases that hinder stock rearing in North Africa, the veterinarians and colonists in Algeria place a cattle disease commonly known as jaundice, the principal symptoms of which are jaundice, haemoglobinuria and fever. In cases ending fatally, the disease rarely lasts more than 5 or 6 days; the animal sometimes succumbs in 24 hours. According to figures quoted, the mortality varies from 5 to 20 %, according to the locality.

The cases of "jaundice" are usually considered as cases of piroplasmiasis, for the chief characters of the disease are identical with those of piroplasmiasis; again, *Piroplasma bigeminum* is known to exist in Algeria.

But a certain number of paradoxical facts have led the authors to doubt the constancy of the etiological role of piroplasms in jaundice. In fact, the researches they undertook at the request of farmers, and which include the observation of 11 cases of jaundice (microscopical examination for piroplasma and other parasitic forms; experimental reproduction of the disease), as well as observations made on apparently healthy animals, have led them to conclude: -

That, out of 11 cases of bovine "jaundice" in Algeria, only one case was caused by piroplasms; there is reason, then, to consider them as due to a dis-

tinct disease, whose etiology is as yet unknown and which should be known as *haemoglobinuric biliary fever of cattle*.

618 — **Serum for the Prevention and Treatment of Exuding Pleuropneumonia of Goats.** — MORI, N., in *Moderno Zootatro*, Series V, Year VII, No, 9, pp. 193-200 + Bibliography of 6 Works. Bologna, September 30, 1918.

During the last months of 1915, a very serious disease of goats appeared in Apulia whence it spread into Basilicata and Latium. Almost exclusively localised in the thorax, the disease occurred frequently, nearly always with fatal results; it was soon recognised as an exuding pleuropneumonia that only attacks goats. It has apparently been introduced into Italy from Albania, where, as in Montenegro and Serbia, it was flourishing at that period. Judging from etiological observations made in Italy it may be admitted that the disease can be propagated at a distance by indirect contagion with various carriers. The author began to study the disease on being directed to do so by the General Directorate of Public Health.

He began by showing that the disease is the same as one that flourished some time ago in Algeria, where it is known as "boufrida", as well as the "goat pleuropneumonia" observed in Germany in 1894-95 and in the "Basses-Pyrénées" (France) in 1895. He was then able to isolate pure cultures of the specific organism with which he reproduced the disease experimentally. He also succeeded in preparing, by using the pleuritic exudate collected aseptically from animals suffering from the disease, a serum that was at once preventive and curative. This serum is injected subcutaneously in the following doses:— minimum for prevention: 1.5 to 2cc. for sucking-kids, 2.5 to 3.5cc. for adults; 3 to 4cc. in presence of the general symptoms of temperature that indicate the disease; 3.5 to 4.5cc. for sick animals, even when dangerously so. A single dose suffices; if a second injection is tried 13 to 23 days after the first, serious anaphylactic phenomena are produced. The author advises that injection should be given in the lower surface of the tail.

Large scale experiments using the MORI serum, carried out by order of the General Directorate of Public Health by Dr. G. MANNA, veterinary officer of Serracapriola (Province of Foggia), and controlled by Prof. BAR-TOLEUCCI, have shown its absolute efficacy for both prevention and cure. Judging from the observations so-far available, the immunity lasts over a year. Post mortem examination of cured animals shows that the exudate has disappeared and is reabsorbed while the pleurae show cicatrization phenomena.

619 — **The Mineral Elements in Animal Nutrition.** — FORBES, E. B., in the *Scientific American Supplement*, No. 2257, pp. 218-219 and 224. New-York, April 5, 1919.

FEEDS
AND FEEDING

Life, considered in a large, general sense, may be looked upon as a coordinated system of responses to an electric stimulant. Ions, especially inorganic ones, are the carriers of this electricity and for this reason may play a preponderating part in the direction of the whole metabolic process.

According to GUSTAVE MANN that which is known as pure proteids, free from ash, is chemically inert and consists of dead bodies in the true sense of the word ; it is the presence of electrolytes which gives them life. The question of the mineral content of food has at the present day become of special importance as a result of the forced feeding of selected breeds of animals in view of the rate at which they mature and their high degree of production. The mineral requirement for maintenance alone is limited in comparison with this requirement for the production of meat, eggs, and milk. The ash content of foods must be greater in proportion as this production is more intense.

The author has studied the chemistry of foodstuffs and made practical experiments on metabolism with pigs and dairy cows. His studies on foods included a set of complete analyses of the ash, the elements of which were calculated by taking as unit the concentration of normal solutions. The data thus obtained were considered with relation to the equilibrium between bases and acids in the organism. He also studied the mineral constituents of Kentucky blue grass (*Poa pratensis*) and the factors influencing the quantities present, and the iodine content of foods in relation to the appearance of goitre.

Animal physiology has shown that the vital processes demand the maintenance of a condition similar to the neutral reaction in the blood and in the lymph. HENDERSON has done much work showing the manner in which this equilibrium between bases and acids is maintained by the spontaneous formation of chemical and excretion equilibriums. The mineral elements of foods contribute to this equilibrium between acids and bases in one way or another. The extent and nature of this contribution are of importance in the question of poisoning by acids, through this condition is rarely brought about by the ration. The authors' many analyses show that cereals, meat, and eggs have acid ash, and fruit, roughage, vegetables, milk, and most Leguminosae, have alkaline ash. Although healthy animals have the means of neutralising the ordinary excess of acid in the ration, it is more hygienic if bases preponderate in it, because it is not known whether the neutralisation of acids does always take place without the expenditure of energy. More over, in any physiological condition causing acid poisoning (and such conditions are numerous) the excess of an acid mineral over bases in the ration is certainly a positive disadvantage.

Acid poisoning is most often found in feeding children suffering from fever, mal-nutrition, and indigestion (especially of the fats in the ration). In such cases the addition of whey to the ration supplies very valuable mineral foods. Sodium citrate (0.24 to 0.48 gm. per 100 gm. of milk) is also excellent as it supplies an alkaline salt which is immediately oxidisable. The presence of citrate also helps the digestion of casein (1).

The author shows that the mineral constituents of Kentucky blue grass vary by more than 100 %, with the fertility of the soil. The frame of growing animals responds rapidly to mineral elements in the ration. There

(1) For other studies on this subject see R. July, 1918, No. 781 (Ed.)

is no definite upper limit to the phosphate deposit in the bones. The quality of the grass influences the quality of the bones, and this influences the strength and production of the animals. The most famous horse-breeding centres of the United States are in Kentucky, the calcareous soils of which have a thick growth of Kentucky blue grass which analyses made by the author have shown to be exceptionally rich in salts. In many places where the soil is impoverished, however, horses and cattle suffer from malnutrition of the bones, especially during the growing period and after a drought. This trouble is soon cured by treatment with calcium phosphate.

By reason of the part it plays in metabolism, iodine, one of the many mineral elements present in minute quantities in food, is of special interest. The thyroid gland contains iodine in quantities which may be increased by administering this element. Such administration also has a curative action on goitre (1), common in certain districts.

The author estimated the iodine in 927 samples of animal and vegetable products. He found it present in $\frac{1}{6}$ of them, but usually in such small quantities that it could only be expressed as traces. Appreciable quantities were found only in agar and bleached Irish moss (*Chondrus crispus*) (the only algae examined). In 18 samples of cow's milk, urine and faeces, in 16 samples of table salt, and 7 varieties of nuts, no iodine was found; it was also very rarely present in spices and other condiments. The fact that iodine was not found in certain foods does not, however, justify the conclusion that it is absent as it may be present in such small quantities as to escape detection by the best research methods.

Of the animal products examined by the author, the only ones that contained iodine in appreciable quantities were pig's feet and hair. Traces of it were found in eggs and some samples of meat, fish, and crustacea.

Many of the cereals examined had no iodine, and some, traces only. The same applied to fruit, in which the traces were yet slighter. Of the vegetables analysed (beets, cucumbers, celery, endive, lettuce, kohlrabi, onions, parsnip, potatoes, spinach, and rhubarb) some contained traces of iodine. This body was also found in $\frac{1}{3}$ of the samples of leguminous seed (beans, peas, cowpeas, and soybeans), and in $\frac{1}{4}$ of the samples of fresh or siloed hay and fodder plants.

Iodine was found in half the samples of manufactured food products, mostly cereals. The external parts of the grain appear to contain more iodine than the internal starchy parts.

The most important sources of iodine for human nutrition are, therefore, firstly vegetables, then, to a lesser degree, cereals, and a few foods of animal origin. The most important sources of iodine for animal nutrition are hay, green or siloed fodder and the by-products of milling and the manufacture of food products, whereas cereals in the natural state contain relatively little iodine.

(1) Also against alopecia and foetal athyreosis. See R., March, 1918, No. 305; April, 1919, No. 440. For further studies on the thyroid gland see R. Sept., 1918, No. 1009. (Ed.)

No regular geographical distribution of the iodine content of foods, or any effect of the nature of the soil and of manure on this content, have been found. Nothing special was found in foods produced in districts where goitre is common. Samples of the same product taken from different parts of the same field often varied considerably in their iodine content.

The author believes that the total iodine requirement of the organism may be satisfied by foods containing such small quantities of this element that, as has been said above, they cannot be traced by the most delicate methods of determination. Where goitre is concerned, the iodine content of the drinking water may be of far greater importance than that of the foods. In a general way this study shows that the cause of goitre must not be sought for in the iodine content of the food, but in the metabolism of the organism.

For his study of mineral metabolism the author chose pigs, the requirements of which are high and often neglected. He investigated the specific effects of maize and maize supplements and compared the food values of several pure phosphorus compounds (1). The studies included feeding, slaughtering, and analyses of the carcasses. It was found that the specific effects of maize as sole food for growing pigs usually resulted in delayed development of the proteid and bone tissues, and an excessive development of the fat tissues. This results in the production of animals with thin bones and weak muscles, small in size and excessively fat, which reach prematurely their maximum growth and are characterised by a breeding capacity below the normal. Decreased breeding capacity seems to arise from a general reduction in proteid increase and lessened circulation of the blood in the female reproductive organs. This last is due to compression exercised by the excessive quantities of internal fat which accumulate round these parts. In pigs fed exclusively on maize, the bones, muscle, liver, kidneys, lungs, heart and spleen contribute to an abnormally small extent to the increase in weight, and fat contributes to this increase to an abnormally high extent. The bones are lacking as much in density, as is shown by their ash content, as in resistance to breaking.

Many of the specific effects of maize as sole food for growing animals are due to its insufficient protein content and the incomplete nature of its most plentiful protein constituent, zein. The only effects which can with certainty be attributed to the mineral constituents of maize are those exercised on the carcass.

In an experiment (2) maize fed alone was compared with maize fed with one of the following foods as a supplement: — soybean, linseed oil meal, wheat middlings, tankage, and skim milk. Rations composed of maize alone and maize and soybean gave the lowest proportion of bone. Maize rations with tankage or skim milk gave the highest proportion of bone. Rations of cereals or other grains did not produce normal bone develop-

(1) See *R.* October, 1916, No. 1088. (*Ed.*)

(2) See *R.* Sept., 1919, No 998. (*Ed.*)

ment in pigs. These facts depend directly on the content of these rations in chemical bone-making elements.

The proportions of calcium, magnesium, and phosphorus in the bones have a strong tendency to remain constant, but may be modified within certain limits by restrictions in the ration and, within much wider limits, by its composition. Bone meal added to a ration poor in calcium and phosphorus greatly increases the ash content and resistance of the bone. The change in external dimensions is slight, but the increase in the density and thickness of the bone walls may increase indefinitely. The speed with which mineral elements may be deposited in the bones, the lack of a definite upper limit for this deposit, and the rapidity with which these mineral elements may be removed make of the frame a real store of mineral elements.

No method of feeding pigs in a small enclosure produced such strong bones as those of pigs left to graze. Possibly the exercise, in addition to the food, has some effect by making the osteogenic cells more greedy of the salts of the bones.

In an experiment on the metabolism of pigs five animals of equal size were used and their metabolism observed during a series of consecutive ten day periods at intervals of seven days. The effects were compared of maize alone and maize with either soybeans, linseed meal, tankage, or skim milk. There was also a ration composed of rice polish and wheat bran. The pigs grew normally and accumulated abundant nitrogen and sulphur in each period, though, naturally, less was accumulated with the ration of maize alone. Potassium was accumulated during all the periods except one; strange to say the ration composed of rice polish and wheat bran supplied the largest quantity of this element. The animals have not the means of accumulating large quantities of potassium salts. The abundant excretion of potassium when large quantities of it were consumed must be considered as a means of protection. In this case negative metabolism does not show shortage.

The metabolism of chlorine and sodium was much influenced by the water absorbed. The ingestion of these elements would have been insufficient if the food had not received cooking salt as a supplement. The animals which drank least water retained most chlorine and sodium.

The most significant results of this experiment were those bearing on calcium, magnesium, and phosphorus. These elements are closely associated in metabolism. In the two rations in which maize was accompanied by skim milk and tankage (containing large quantities of bone scrap) the quantity of calcium retained was nine or ten times greater than in any other ration containing grain, and other seeds or seed products. With the rations of maize alone, maize and soybeans, or rice polish and wheat bran, the metabolism of the calcium was negative, that is to say it was excreted in larger quantities than those absorbed with the food. This shows that cereals are little suited to the formation of bones. The negative metabolism of calcium in the ration of maize and soybeans shows that the unusually high calcium content of Leguminosae concerns the

whole plant, not the seeds, and emphasises the value of leguminous hay as a bone-making food.

In these experiments the retention of calcium was closely related to its ingestion and was not appreciably modified by an excess of mineral acidity. Physiologically the metabolism of calcium and magnesium are opposed. An excess of magnesium in the blood causes a setting-free of calcium which counterbalances it, but the ratio of these elements in the blood is not in strict accordance with their ratio in the ration. The retention of calcium was not found to be limited by an excess of magnesium in the ration, except, perhaps, in a single case, when it was composed of rice polish and wheat bran, and contained twelve times more magnesium than calcium. In this case the great excess of magnesium appears to have been unfavourable to the retention of calcium. This proportion does not appear to be of practical importance in ordinary rations.

Phosphorus metabolism was always positive with the rations used, but retention was below normal with a ration of maize alone. The principal reason of the insufficient storing up of the phosphorus in maize was the lack of calcium, as there was a greater shortage of calcium than of phosphorus, and both can only be accumulated in large quantities in the ratio in which they are combined in the calcium phosphate of the bone.

There was a great excess of acid minerals in the rations, and these were neutralised by ammonia. No symptoms of acid poisoning were observed. Acid poisoning is rarer in domestic animals than in man.

The excretion of ammonia in the urine varies with the excess of acid in the ration, providing the protein content remains about the same. Any considerable increase of protein in the ration caused an increase in the ammonia of the urine.

In another series of experiments on the metabolism of phosphorus in pigs attempts were made to determine whether the organic and inorganic phosphorus in the ration meet equally well all the ends for which the animals require phosphorus. Whereas inorganic phosphorus may be had in unlimited quantities (mineral phosphate, bone meal) and may be largely increased in the crops by the use of fertilisers, organic phosphorus is only present in expensive foods (milk, eggs, meat) and in cereals and is not appreciably modified by treating the soil. The above-problem is most complicated and different workers have given different solutions of it. It seems certain, however, that inorganic phosphorus can supply all the phosphorus requirements of animals. There are, nevertheless, differences in the metabolism of certain organic and inorganic phosphorus compounds; this seems to show, at least, a large utilisation of organic phosphorus for certain purposes and certain animals.

In the author's experiments orthophosphates, glycerophosphates, hypophosphites, phytin, and nucleic acid extracted from yeast were all absorbed and retained to a certain extent. The pigs showed very different limits of tolerance for the different compounds. The glycerophosphate were accepted best, the orthophosphates much less so, phytin and nucleic acid still less so, and hypophosphites least of all. It was not possible to prove

that organic compounds of phosphorus have a higher food value than simple inorganic phosphates for young growing pigs. The ordinary rations for growing animals seem to contain a sufficiently high proportion of organic compounds of phosphorus as compared with the inorganic compounds and, in such rations, the supplementary phosphorus may be added in an inorganic form. If the quantity of phosphorus tolerated by an animal be added to the diet in a rapidly soluble form, it is definitely limited to a quantity much below that acceptable in its natural condition in the food.

It does not seem probable that rations composed of natural foods, supplying a sufficient quantity of nitrogen, do not also supply sufficient quantities of phosphorus to maintain the metabolism of this element. It is, however, certain that many rations lack the quantity of phosphorus necessary to maximum retention and development. The addition of isolated phosphorus compounds to rations probably limits its practical effect on the density and hardness of the bones ; but it is still possible that it may greatly influence the physiological functions.

The author made a final study of the mineral metabolism of dairy cows (1). Dairy cows greatly surpass all other breeding animals by the rapidity and intensity of their production of proteid and mineral foods and, consequently, in their food requirements. This is generally recognised with respect to their protein requirement. The author's experiments have proved that there is no justification for the belief that no attention need be paid to their requirement in mineral elements. He found that an abundant milk production obtained by common winter rations fed in quantities sufficient to maintain live weight and produce an ample and regular accumulation of nitrogen and sulphur, causes heavy, continual losses in the calcium, magnesium, and phosphorus of the frame in spite of an ample supply of these in the ration. The limited response of cows to a large increase in the quantity of these foods absorbed seems to show that the improvement of dairy cows for milk production by selection has exceeded the capacity of the animal to digest mineral foods.

A strong metabolism of silicon was shown. An excess of inorganic acids over inorganic bases, largely due to the silicon in timothy hay, caused an acid reaction and an increase in the amount of ammonia in the urine.

The incapacity of the best dairy cows to maintain mineral metabolism unless pasture is available must be a general phenomenon. It is probably to this that the frequent incapacity to maintain an exceptionally high yield during two consecutive lactation periods must be attributed, as well as the frequent inability to breed after a period of force 1 milk production.

Cow's rations should supply plenty of calcium, magnesium, and phosphorus, both during and between the lactation periods.

These studies emphasise the importance of liming and the cultivation of Leguminosae in agriculture.

(1) See R. July, 1917, No. 648. (*Ed.*)

620 - **Comparative Study of the Digestion of Bran by the Rabbit and Dog.** — CHAUSSIN, J., in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXII, No. 8, pp. 269-271 + 2 Tables, Paris, March, 1919.

The authors has undertaken a series of experiments on feeding the rabbit and dog with bran, in order to compare the undigested residues in these two animals.

The dog received 50 gm. of bran mixed with 160 gm of white flour, 10 gm. of casein and 10 gm. of fat. Two rabbits were given 50 gm. of bran mixed with 150 gm. of chopped carrots. The residues left by the bran after passing through the digestive apparatus were then determined by sieving. It was found that the undigested residue left from each 100 gm. of dry bran ingested was 50.6 gm. for the dog and 25 to 26 gm. for the rabbits. In another experiment the author fed the dog with the washed residue from a first passage through the digestive apparatus mixed with a paste made by swelling whole wheat in water, then simply crushing it between smooth rollers so as to avoid breaking the envelopes; the rabbits were fed successively with: — 1) the washed residue left after the dog had digested the bran in the first experiment; 2) the washed residues left after the rabbit had digested the same bran. The undigested residue expressed as percentages of the dry matter ingested during this double digestion experiment were: — dog (envelopes of wheat already digested by the dog) 86.20, rabbit (bran digested by the dog in the first experiment), 58.4; rabbit (bran digested by the rabbit in the first experiment), 69.5.

The author points out that these figures are mostly of comparative value; for the materials which they express have undergone drying at 105° C. before their second ingestion, and their properties may have undergone alteration.

CONCLUSIONS. — The rabbit digests nearly 75 % of commercial bran and 40 % of the residues left after the dog has digested the bran; it digests 30 % of the residues of the bran that it had previously digested once itself, while the dog only digests 13 % of the residues of the bran that had already passed through its alimentary canal. These residues have lost most of their minerals in the case of the dog, but they have lost little in the case of the rabbit, which can be explained by the different acidity of their digestive juices.

The estimation of the total nitrogen by the Kjeldahl method has shown that the nitrogenous matter of the envelope of wheat is much more attacked by the digestion of the dog in the bran that has undergone the usual milling operations than in the whole envelopes obtained by simply crushing the wheat.

621 - **The Use of the Contents of the Rumen as Cattle Food (1); Researches in Italy.** — ARUCH, E and BELTRAMI, in *L'Italia Agricola*, Year 55, No 8, pp. 236-240. Piacenza, August, 1918.

It is known that, in the food contained in the rumen and which is mixed with large quantities of saliva, the starches are transformed into dextrine and sugar, but it is not yet known what changes the albuminoids undergo. In their researches, the authors have particularly attempted to

(1) See also R., April, 1915. No 633, and R., October, 1918, No. 1141. (Ed.)

remove the disagreeable odour of the rumen, owing to which no animal will eat it; this can be done by rapid washing, followed by drying in thin layers.

The contents of the rumen (which, on removal, weigh 30 kg.), after having been repeatedly washed, then dried for 3 hours in the sun, have the appearance of a hash of yellowish hay, almost odourless, and whose weight is reduced to 4 kg. On mixing 2 kg. of this residue + 2 kg of ground grape residue with a little water, an appetising mash for calves is obtained, though cows refuse it. The contents of the rumen, washed and dried, has the following percentage composition: — Water, 7.86; Ash, 2.50; Nitrogenous matter, 6.25; Fat, 1.70 — that is, a composition very similar to that of average quality hay.

In another experiment, the contents of 20 rumens, weighing 600 kg., was pressed in an electric press, then dried; after 18 hours the mass did not weigh more than 135 kg. This product, with a disagreeable smell, was not very appetising for cattle; however, calves ate it, at first mixed with decreasing quantities of grape residue, then alone. Chemical analyses showed the poor feeding value of this product (Water, 11.45%; Ash, 9.90%; Proteins, 3.55%; Fat, 3.05%; Glucose, 0.35%; Dextrine, 0.70%; and also that, in the product prepared in this way, the protein content had much decreased in contrast to the preceding product, while the fat content had increased. The analysis of the liquid pressed out showed that it contained 5% of albumen. The effect of digestion in the rumen is, therefore, to render the proteins soluble.

Another sample of the contents of the rumen was neither washed nor pressed, but dried directly at 90° C. for 24 hours; in this way 2000 gm. of raw material yielded 200 gm. of a product with the following percentage composition: — Water, 7.88; Ash, 13.66; Protein, 12.40; Fat, 2.48; Carbohydrates (expressed as starch), 7.35; Dextrine and allied substances, traces; Nitrogen-free extract, 30.13.

In a feeding experiment that lasted 20 days, 5 calves (group I) received the following ration per day per head: — hay, 5 kg.; straw, 2 kg.; bran, 2 kg.; flour, 2 kg.; washed and sun-dried rumen-content, 1 kg.; 5 other calves (group II) received the same ration, but the rumen-content was replaced by an equal weight of grape residue. In the two groups, the increase in live-weight per day per head was 1.209 and 1.304 kg. respectively, i. e., the increase in weight obtained with the rumen content was only 95 gm. less than that given by the other, which is surprising when it is remembered that grape residue has a much richer composition; the rumen-content is, therefore, much more digestible than grape residue.

In a second experiment, 2 kg. of bran were introduced into the ration of the calves, and in a third, 3 kg. of bran, adding to it 2 kg. the first time and 3 kg. the second time of dried, odourless rumen-content (not previously washed); the increases in live weight were practically the same in both experiments.

To sum up, it has been shown that the contents of the rumen can be made into a utilisable food; the cheapest and best method for preparing it consists in drying it in the sun followed by desiccation in a stove.

CATTLE

622 - **Cattle-Feeding with the By-Products of the Erytrea Corozo Nut: Experiments in Italy.** — BELTRAMI, in *L'Italia Agricola*, Year.LVI, No. 2, pp. 51-53. Piacenza, February, 1919.

The manufacture of buttons from the Erytrea corozo-nut (*Hyphaene thebaica*) has developed considerably at Piacenza. This vegetable ivory is less white and hard than the American corozo (from *Phytelphas macrocarpa* and *Ph. microcarpa* (1) but it is easier to work and costs less (about 20 % and even more). The by-products from the manufacture of buttons consists in a white, light odourless meal which has been long used for the preparation of complex foods; in Italy this meal is used to make a coffee substitute, and several attempts have been made to utilise it for the preparation of alcohol, but without success from an industrial point of view.

The analyses of the American corozo have given very variable results, which is perhaps why such variable results have been obtained in feeding experiments with it. Generally speaking, it is relatively poor in nitrogenous matter and fats, whilst the Erytrea corozo is exceptionally rich in fat, fairly rich in albuminoids and well furnished with pentosans, as is shown by the analyses of two samples, one American, the other from Erytrea, made by Prof. MENOZZI: —

	American Corozo	Erytrea Corozo
Moisture.	11.05 %	10.35 %
Ash. . .	1.10	—
Crude protein	4.31	4.70
Fat	1.03	10.20
Cellulose. . .	4.20	14.00
Pentosans . .	2.20	2.10
Nitrogen-free extract (except the pentosans)	76.11	59.00

The rich composition of Erytrea corozo led the author to ascertain its feeding value. Ten adult cattle of the same breed, almost of the same age and of the same condition as regards feeding, were fed for 24 days on a ration in which corozo meal, gradually increased from 0.5 to 3 kg., replaced an equal weight of bran. The animals made a collective daily gain in live weight of 12.58 kg., against 13.50 kg. in a control group.

CONCLUSIONS. — 1) The by-products of Erytrea corozo constitute a food of high nutritive value.

2) Assuming that the meal forms 85 % of the weight of the seed worked, an annual supply of about 40 000 quintals of this product can be counted on in Italy.

3) Owing to its digestibility and food value, it is not necessary to make it into a cake, and it only requires mixing with the other cattle foods, even at the rate of 2 to 3 kg. per day per head.

(1) As regards American vegetable ivory meal (composition, feeding value, feeding experiments), see *R.*, March, 1917, No. 259. (*Ed.*)

623 - **Fattening Western Lambs in the United States.** — SKINNER, J. H. and KING, F. G., in the *Purdue University Agricultural Experiment Station, Bulletin* No. 202, Vol. XX, 20 pp. Lafayette, Indiana, August, 1917.

The experiments described are a continuation of previous ones on the fattening of lambs (1). They were made with 9 lots of 25 Colorado lambs and lasted from November 2, 1916 to March 2, 1917 (150 days). The results are summarised in the appended table. The financial results are based on the following prices: — Maize fed per head, 1st month 36.4 cents, 2nd month 85 cents, 3rd month 93.7 cents, 4th month 97 cents; Oats, 50 cents per bushel; Cottonseed meal and ground soybeans \$ 45.00 per ton; Maize silage \$ 6.00 per ton, Clover and alfalfa hays \$ 12.00 per ton. The wool was valued at 33 $\frac{1}{4}$ cents.

I. — *Comparison between maize silage alone and maize silage and dry roughage for fattening lambs* (Lots 1, 3, 6). — In this test the lambs of one of the lots receiving maize silage alone were given clover hay once in every five days in order to maintain their appetites. This addition had been found necessary in previous experiments in which the animals suffered from loss of appetite when fed maize silage exclusively. All the lots received a basal ration of shelled maize and cottonseed meal in the ratio 7 : 1. The roughage which gave the best results was maize silage and clover hay *ad lib.* The least satisfactory results were obtained with maize silage alone.

II. — *Comparison between clover hay (Lot 3) and alfalfa hay (Lot 4) as roughage for fattening lambs.* — The authors had previously made three experiments on this subject. Of the four, two were in favour of clover hay and two in favour of alfalfa hay. Wherever there was a difference in the quality of the hay, the better quality gave the highest gains. In this experiment alfalfa hay gave the best results.

III. — *Comparison between alfalfa hay (Lot 4) and alfalfa hay and maize silage (Lot 5) as roughage for fattening lambs.* — Lot 4, which was also used in the preceding test, received shelled maize and alfalfa hay, and Lot 5, the same ration with the addition of maize silage. Alfalfa hay alone gave the best results as roughage.

IV. — *Comparison between ground soybeans (Lot 8) and cottonseed meal (Lot 7) as supplements to the ration for fattening lambs.* — The fattening ration was composed of shelled maize, maize silage, and clover hay. Cottonseed meal as a supplement yielded a greater profit, but soybeans gave more economical gains.

V. — *Influence of shearing of fattening lambs (Lots 2 and 7).* — Lot 2 was shorn at the beginning of the experiment and yielded 57lb. of wool. This lot had better appetites, but gained less than Lot 7; it also gave a much lower profit per lamb when sold for slaughtering.

VI. — *Comparison between open shed (Lot 2) and barn (Lot 9).* — All the lambs in this experiment were shorn. Those kept in the barn ate the same amount of grain and maize silage as those in the open, but less hay, and also gave less satisfactory results,

(1) See R. June, 1918, No. 669. (Ed.)

General results of experiments in fattening

	Lot 1	Lot 2
	Shelled maize, cotton- seed meal, maize silage	Shelled maize, cottonseed meal, maize silage, clover hay (shorn)
Number of lambs per lot :	24	25
Initial cost \$	11.00	11.00
Initial weight lb.	1 443	1 503
Final weight lb.	1 862	2 290
Total gain lb.	419	844
Average daily gain lb.	0.145	0.281
Total food consumed :		
Shelled maize lb.	2 318.5	2 747
Oats lb.	143	145
Cottonseed meal lb.	326.5	387.5
Ground soybeans lb.	—	—
Maize silage lb.	5 538	4 493
Clover hay lb.	610	3 472
Alfalfa hay lb.	—	—
Average daily food :		
Grain lb.	0.97	1.09
Maize silage lb.	1.92	1.50
Dry roughage lb.	0.04	1.16
Feed per lb. gain :		
Shelled maize lb.	5.53	3.25
Oats lb.	0.34	0.17
Cottonseed meal lb.	0.78	0.46
Ground soybeans lb.	—	—
Maize silage lb.	13.22	5.32
Clover hay lb.	0.26	4.11
Alfalfa hay lb.	—	—
Cost of food consumed :		
Shelled maize \$	37.81	45.17
Oats \$	2.23	2.27
Cottonseed meal \$	7.35	8.72
Ground soybeans \$	—	—
Maize silage \$	16.61	13.48
Clover hay \$	0.66	20.83
Alfalfa hay \$	—	—
Total cost of food consumed \$	64.66	90.47
Cost per 100 lb. gain \$	15.43	10.72
Cost of lambs \$	158.73	165.33
Total cost of fattening 1 lamb \$	223.39	255.80
Total receipts \$	251.37 (2)	288.08
Net receipts (deducting loss by death) (3) \$	243.38	279.76
Total profit \$	19.99	23.96
Profit per lamb \$	0.83	0.96

(1) Total grains in Lots 2 and 9 include 57 lb. of wood each. — (2) Total receipts in Lots 2 and 9 in

western lambs in the United States.

Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9	Average of all lots
Shelled maize, clover hay	Shelled maize, alfalfa hay	Shelled maize, maize silage, alfalfa hay	Shelled maize, cottonseed meal, maize silage (clover hay every 5 days)	Shelled maize, cottonseed meal, maize silage, clover hay	Shelled maize, ground soy- beans, maize silage, clover hay	Shelled maize, cot- tonseed meal, maize silage, clover hay, (shorn and fed in barn)	
25 11.00	25 11.00	25 11.00	25 11.00	25 11.00	25 11.00	25 11.00	224 11.00
1 480	1 470	1 491	1 492	1 489	1 495	1 475	13 338
2 340	2 386	2 355	2 207	2 401	2 373	2 246	20 574
866	916	864	715	912	878	(1) 828	7 236
0.287	0.305	0.288	0.238	0.304	0.293	0.276	0.269
3 132	3 192	3 226.5	2 848	2 931	2 747	2 747	25 889
145	145	145	145	145	145	145	1 303
—	—	—	402	413	—	387 5	1916 5
—	—	—	—	—	387.5	—	387 5
—	—	4 206	5 377	4 277	4 068.5	449 3	324 52.5
4 952	—	—	694	2 962	2 883	313 5	18 208
—	4 792	2 856	—	—	—	—	7 638
1.09	1.11	1 12	1.13	1.16	1.09	1.09	1.10
—	—	1.10	1.79	1.42	1.36	1 50	1.21
1.65	1 59	0.95	0 23	0.99	0 96	1.05	0.96
3.64	3.48	3.73	3.98	3 21	3.13	3 32	3.58
0.17	0.16	0.17	0 20	0.16	0.17	0.18	0 18
—	—	—	0.56	0.45	—	0.17	0.26
—	—	—	—	—	0 41	—	0.05
—	—	4 67	7 52	4.69	4 63	5.43	4.48
5.76	—	—	0.97	3.25	3 26	3 79	2.52
—	5 22	3 31	—	—	—	—	1.06
51.52	52 55	53 06	46.85	16 27	15.17	45.17	425.57
2.27	2.27	2.27	2.27	2.27	2.27	2.27	20.39
—	—	—	0.05	0 29	—	8.72	43.13
—	—	—	—	—	8.72	—	8.72
—	—	12 62	16.13	12.83	12.21	13.48	97.36
29.71	—	—	4.16	17.77	17.30	18.31	109.24
—	28.69	17.14	—	—	—	—	45.83
83.50	83.51	85.09	78.46	90.43	85.67	88.45	750.24
9.71	9.12	9.85	10 97	9.92	9 76	10.68	10.37
162.80	161.70	164 01	164.12	163.79	164.45	162.2	1 467.18
246.30	245.21	249.16	242.58	254 22	250 12	250.70	2 217.42
321.75	334.04	332.06	306.77	342.14	335.78 (2)	271.68	2 783.67
313.43	325.72	323 74	298.45	333.82	327.46	263.36	2 709.12
67.13	80.51	74.64	55.87	79.66	77.34	12.66	491 70
2.69	3.22	2.99	2.23	3.18	3.09	0.51	2.20

clude \$ 19.00 in each lot from wool. — (3) Death losses are evenly distributed between all lots.

624 - Rearing a Wool Producing Breed of Sheep in the Sudan. — HENRY, YVES, in *L'Agronomie coloniale, Bulletin mensuel du Jardin colonial*, Year III, 1918-19, No. 22, pp. 97-108 + 4 Photographic Plates + 1 Map. Paris, January-February, 1919.

Out of all its colonies, France has obtained up to a few years ago appreciable quantities of wool from North Africa only. Since 1906, the completion of the railway from Conakry to the Niger has made it possible to open out a new region for rearing: the central Niger basin, which does not produce much, but is capable of becoming a first-class wool-producing centre.

The wool sheep of the Niger is the same as the thin-tailed "Barbarin" of North Africa; it is a poor mutton-producer; the live weight is rarely more than 25 kg. for the female and 30 kg. for the male; the muscles are not much developed, the animal is bony and the meat mediocre. The females are bad milkers and can hardly feed their lambs; the first lambs born die in great numbers.

The fleece is open, with scanty locks (600 to 700 gm. per year). The wool is long (an average of 5 to 8 cm.), very slightly wavy and is one of the coarsest wools in existence. Many of the fleeces are coloured or with long, coarse hairs (in the Great Lake region and Niafunké, not more than 50% of the fleeces are white). Not more than 15 or 20 % of the skins are free from pigment and not more than 10 % of mucosae free from blotches. The fleece usually covers the body and frontal bone.

From the commercial point of view, Nigerian wool has always been considered as of very inferior quality. From the very first it was declared unsuitable for weaving and only fit for making coarse felts, carpets and mattresses. In spite of this it has been used, after sorting and mixing, with wools of different origins, for making cloth. Since the manufacture of the rough cloth known as "drap anglais" has become common, it is in general use. M. P. AMMANN has shown that the quality of the fleece varies considerably, from hairy wools suitable for making mattresses to those that could be spun in Rhinims, and he points out that it would be an advantage for trade purposes were the wool properly graded for sale in France (1).

The official census states that the breed numbers about 800 000 head and that 400 to 500 metric tons of wool are produced annually. The flocks are nearly all in the hands of the Foulbes and live between 14° and 17° of north latitude, in the immense fresh-water basin that the Niger forms above Timbuctoo and whose centre is occupied by lake Debo. The habitat varies with the height of the Niger, high water forcing the flocks to leave the basin and low water bringing them back.

The flocks live exclusively on the natural pastures, as the Peuhl grow no crops and store no forage. This is why, given the severity of the semi-desert climate of the country and the enormous distances travelled by the flocks, rearing is so little prosperous.

The question of feeding is of primary importance in the improvement

(1) See R., March, 1919, No. 376. (Ed.)

of breeding and wool-production. Experiments have shown that the solution of the problem has been found. The flat parts of the natural pastures, roughly treated by cutting, furnish good forage. The "borgou" (an aquatic grass, whose shoots are eaten by the sheep when the waters have receded in the dry season and which is propagated by seeds or by cuttings placed in the mud), when cut at the right time, makes first class straw; certain species of acacia furnish large quantities of pods rich in starch and sugar, which are much liked by the sheep (1).

Apart from these natural resources, forage crops should be grown everywhere as the waters recede, on the ground when sufficiently dry or by means of irrigation. The question is of a more general nature: the grower cannot obtain cotton by irrigation or any other fibre crop under normal conditions unless he introduces into his rotation a leguminous crop whose products he would utilise; this would be done by live stock, especially sheep.

In the Niger district, according to the conditions of rearing, selection and crossing will have to be carried out, and the second method will predominate more and more as crop cultivation improves.

Experiments made on the author's suggestion have furnished abundant proof that merinos do very well in the Niger district and that crossing them with the native breed quickly improves it for wool and mutton production. Hornless merino rams, out of Berry, are amongst the most vigorous and suitable types.

To avoid shearing before the wool is sufficiently long, it should be arranged with the trade to have two selling seasons of one to two months each corresponding with the usual shearing times (March-April and August-September) at fixed places which would become permanent markets closed to wool for the rest of the year.

625 - **The First Official Attempts to Establish Sheep in Japan.** -- GUÉLIN (French Consul at Yokohama), in the *Bulletin économique de l'Indochine*, Year XXI, New Series, No 133, p. 1129. Hanoi-Haiphong, November-December, 1918

In order to render Japanese spinners independent of foreign countries as regards their supply of raw material, the Imperial Government has, since 1917, established sheep-rearing stations at Takikawa (in Hokkaido) and in other places. The desire is gradually to build up a sheep population. The first attempts have been crowded with success and already some hundreds of lambs are ready for distribution to the farmers.

At present, the total number of sheep in the Empire consists of only 3590 head, and the annual production of wool is only 100 00 "kin" (13 200 lb.) The Japanese wool industry is, therefore, almost entirely dependent on foreign supplies. But the war seems to have opened the Government's eyes, for they are trying to make up for this lack of raw material, although the climatic conditions — which are mostly damp — are not very favourable to sheep rearing in Japan.

(1) See *Acacias à tannins du Sénégal*, by YVES HENRY and P. AMMANN and published by A. Chalamel, Paris. (Ed.)

The official rearing stations already possess 500 picked ewes for breeding purposes. This number will soon be doubled owing to the number bought in Australia, China and in both Americas. Eighty head imported from China have been sent to the Tomobé farm, which is situated in the prefecture of Ibaraki. A lot of 300 was brought from Australia (part was placed at the above mentioned farm at Hokkaido and another, of about 100 head, in that at Kumamoto). Fifty sheep for the Tomobe station have just arrived from South America. Eighty sheep are also expected from the United States.

The 500 ewes imported in 1917 have already produced 300 lambs in 1918, and as soon as these are strong enough, they will be distributed to the farmers.

The Government is now studying the question of the professional training of sheep rearers, which is naturally of great importance for the success of its interesting undertaking.

POULTRY

626 - **Experiments with Laying Hens, in Ohio, U. S. A.** — Buss, W. J., in: — *Ohio Agricultural Experiment Station, Bulletin No. 291*, pp. 185-217. Wooster, Ohio, February, 1916—II, *Ibid.*, No. 322, pp. 199-211, March, 1918

I. — Three experiments were made to compare the laying of confined hens with that of hens left free. The results are summarised in Table I.

TABLE I — *Comparative effects of confinement and freedom.*

Experiment	Treatment	Duration days	Average Number of hens per lot	Mortality %	Increase (+) or loss (-) in weight per hen lb	Cost of food per hen ¢	Eggs laid per hen	Cost of food per dozen eggs cents	Value of eggs per hen ¢
1	Confined	88½	85	23.23	— 0.16	1.96	241	9.75	4.22
	Free		96	15.53	— 0.09	1.97	278	8.49	4.85
2	Confined	728	51	17.50	+ 0.02	1.69	244	8.31	4.57
	Free		54	12.30	+ 0.04	1.74	316	6.59	6.16
3	Confined	364	91	20.00	+ 0.41	0.74	90	9.95	1.69
	Free		93	21.80	+ 0.47	0.79	129	7.30	2.41

Other experiments aimed at determining whether rations containing a variety of foods give a sufficiently great increase in production to justify the extra labour and expense entailed. Lot 1 received shelled maize and a mash of ground maize and meat scrap in the ratio of about 8 : 5. Lot 2 received shelled maize and a mash of ground maize, bran and meat scrap in the ratio of 11 : 4 : 8. Lot 2 received in one experiment shelled maize, wheat and oats and a mash of ground maize, bran, and meat scrap in the ratio of

10 : 10 : 7, and in another the same grain ration with a mash of ground maize, bran, middlings, linseed oil meal, and meat scrap in the ratio 3 : 4 : 4 : 1 : 2. The results of the two experiments are given in Table II.

TABLE II. — *Comparative effects of simple rations and varied rations.*

Experiment	Duration. days	Lot	Average number of hens per lot	Mortality %	Gain in weight per hen	Cost of food per hen	Eggs laid per hen	Cost of food per dozen eggs	Value of eggs per hen
					lb.	\$		cents	\$
1	10.47	1	21	29.2	0.48	2.27	351	7.74	6.45
		2	19	37.5	0.53	2.19	293	8.99	5.28
		3	22	33.3	0.34	2.77	371	8.98	6.88
2	67.2	1	22	20.0	0.36	1.35	185.9	8.73	3.44
		1	21	32.0	0.36	1.35	189.8	8.54	3.50
		3	24	8.0	0.11	1.84	201.6	10.96	3.82

In an experiment lasting 364 days made to determine the effect of rations containing approximately 10, 15, and 20% of protein on the rate and cost of egg production, all the groups received the same grain mixture, maize and wheat in the ratio of 3 : 1. The mash of the different lots included ground maize, bran, and meat scrap, in the ratio of 11 : 3 : 1 for Lot 1, 6 : 3 : 6 for Lot 2, and 1 : 3 : 11 for Lot 3. Table III shows the results.

TABLE III. — *Comparative effects of different amounts of protein in the ration.*

Lot	Percentage of protein in ration	Breed	Average number of hens per lot	Mortal- ity %	Gain (+) or loss () in weight per hen	Cost of food per hen	Eggs laid per hen	Cost of food per dozen eggs	Value of eggs per hen
					lb.	\$		cents	\$
1	10	Barred Plymouth Rock	52	28.8	+ 0.55	0.90	105	10.26	1.99
2	15	" " "	51	24.6	+ 0.60	1.17	158	9.88	2.98
3	20	" " "	50	33.9	+ 0.84	1.25	124	12.16	2.30
1	10	White Leghorn . . .	58	8.3	+ 0.17	0.66	93	8.51	1.70
2	15	" " . . .	57	13.3	— 0.19	0.85	142	7.17	2.63
3	20	" " . . .	58	6.7	+ 0.02	0.97	133	8.79	2.44

II. — The experiments described were a continuation of those given in the last paper, and confirm the results. Further experiments were made on the comparative effects of different feeding methods, the laying of hens born at the beginning, middle, and end of the season respectively, and the comparative effects of maize and wheat as dry foods.

The results of three experiments, made in continuation of the previous ones, to compare the laying of confined hens and free hens are given in Table IV.

TABLE IV. *Comparative effects of confinement and freedom*

Experiment	Treatment	Du- ration days	Aver- age number of hens per lot	Mor- tality %	In- crease (+) or loss (—) in weight per hen lb.	Cost of food per hen \$	Eggs laid per hen	Food con- sumed per dozen eggs W.	Differ- ence between cost of food and value of eggs \$
1	Confined	364	39.82	18.2	+ 0.14	1.34	100.2	6.95	1.09
	Free		43.51	22.0	+ 0.16	1.37	115.7	6.15	1.47
2	Confined	364	43.76	18.4	— 0.09	1.31	91.3	7.46	0.88
	Free		43.17	26.0	+ 0.01	1.32	101.5	6.76	1.13
3	Confined	336	72.88	17.2	— 0.04	1.13	72.6	8.11	0.61
	Free		72.56	31.2	+ 0.05	1.10	111.5	5.11	1.57

Continuing the previous experiments on the necessity of varied food for laying hens, one lot was added to compare the value of meat scrap and tankage as protein foods. Each lot received shelled maize and, in addition, Lot 1 received a mash of ground maize and meat scrap in the ratio of 8 : 5, Lot 2 a mash of ground maize, bran and meat scrap in the ratio of 7 : 3 : 5, Lot 3 wheat and oats (2 : 1) and a mash of ground maize, bran, middlings, linseed oil meal, and meat scrap (4 : 4 : 4 : 1 : 3), and Lot 4 a mash of ground maize, bran, and tankage (7 : 3 : 4). The experiment lasted 728 days. Table V shows the most important results.

TABLE V. -- *Comparative effects of simple rations and varied rations.*

Lot	Average number of hens per lot	Mortality %	Gain in weight per hen lb.	Mash and grain consumed per hen lb.	Eggs laid per hen	Food consumed per dozen eggs lb.	Difference between cost of food and value of eggs \$
1	28.13	10.0	0.17	119.15	241.3	5.92	3.23
2	27.10	23.3	0.04	118.67	242.6	5.87	3.32
3	25.66	23.3	0.09	131.49	261.3	6.04	3.47
4	27.98	13.3	0.11	117.88	240.9	5.87	3.40

The comparison between various protein contents (10, 15, and 20 %) in the ration was continued. The experiments included: — *a*) two-year White Leghorn hens (during 308 days; *b*) one-year White Leghorn hens (during 364 days; *c*) Barred Plymouth Rock hens (during 224 days). The rations were the same as those used in the previous test. The results are summarised in Table VI.

TABLE VI. — *Comparative effects of different amounts of protein in the ration*

Lot	Protein in ration %	Breed	Average number of hens per lot	Mor- tality %	Increase (+) or loss (-) in weight per hen lb.	Mash and grain con- sumed per hen lb.	Eggs laid per hen	Food con- sumed per dozen hens lb.	Difference between cost of food and value of eggs \$
1	10	Barred Plymouth Rock	33.62	28.6	+ 0.22	47.89	61.4	9.35	0.45
2	15		37.17	27.9	+ 0.32	49.16	63.6	9.27	0.35
3	20		37.36	10.3	— 0.18	44.51	48.5	11.00	—
1	10	White Zeghorn, 2 gears.	50.02	16.4	— 0.17	46.80	83.5	6.72	0.95
2	15		49.81	9.6	+ 0.11	50.01	93.6	6.41	1.03
3	20		54.41	5.4	— 0.01	46.71	77.1	7.27	0.63
1	10	White Zeghorn, 1 gear	58.58	6.7	+ 0.32	58.19	93.6	7.16	1.09
2	15		56.18	15.0	+ 0.28	64.40	139.6	5.54	2.01
3	20		55.66	10.7	+ 0.06	63.56	128.5	5.94	1.58

To compare the effect of six different methods of feeding, a 727 day experiment was made with six lots of thirty one year White Leghorn hens. Lots 1, 2, and 3 received a mixture of shelled maize, wheat, and oats (3 : 2 : 1) and a mash of ground maize, bran, middlings, linseed oil meal, and meat scrap (4 : 4 : 4 : 1 : 3). Lot 3 received no grain but only the mash. Lot 5 was fed the grain mixture and meat scrap, and Lot 5 received a different ration, composed of the above foods, every month. Lots 1 and 7 had grain scattered in the litter and dry mash in hoppers. Lot 2 received the grain in a trough and the dry mash in hoppers. The grain of Lot 3 was scattered on the litter and the mash, damped once a day, was put in a trough. The dry mash of Lot 4 was placed in a hopper. Lot 5 had grain mixed with the litter and meat scrap once daily in a trough. Table VII gives a summary of the results obtained.

TABLE VII. — *Comparative results of different methods of feeding*

Lot	Average number of hens per lot	Mortality %	Increase (+) or loss (-) in weight per hen lb.	Grain and mash consumed per hen lb.	Eggs laid per hen	Food consumed per dozen eggs lb.	Difference between cost of food and value of eggs \$
1	28.77	16.3	+ 0.03	130.06	250.6	6.23	3.24
2	28.70	3.3	+ 0.12	125.02	249.6	6.01	3.28
3	30.00	—	— 0.06	127.27	256.2	5.96	3.41
4	27.66	20.0	+ 0.05	122.89	246.8	5.97	3.13
5	27.24	26.7	+ 0.28	116.62	228.9	6.12	2.77
6	26.78	16.7	+ 0.16	122.67	255.2	5.77	3.54

An experiment was made to determine the effect of different periods of hatching on the number and value of the eggs and the cost of food per dozen eggs for one-year White Leghorn hens. Each lot of hens was placed under observation as soon as it began laying, and removed when laying stopped after the first year of production. The hens of Lot 1, hatched on February 22, began to lay on August 10, those of Lot 2, hatched on April 22, began to lay on November 2, and those of Lot 3, hatched on June 13, began to lay on December 28. The rations consisted of shelled maize and wheat (3:1) and a mash of ground maize, bran, and meat scrap. Some of the results are given in Table VIII.

TABLE VIII — *Effect of date of birth on egg production*

Lot	Du- ration days	Average number of hens per lot	Mortality %	Increase (+) or loss (-) in weight per hen lb	Grain and mash consumed per hen lb	Eggs laid per hen	Food consumed per dozen eggs lb	Difference between cost of food and value of eggs \$
1	148	29.01	6.7	+ 0.04	83.55	166.9	6.01	2.22
2	392	28.36	10.0	+ 0.15	75.69	150.4	5.81	2.16
3	336	29.50	3.3	- 0.08	60.61	144.0	5.05	2.11

To determine whether wheat can replace maize in the rations of laying hens a first experiment (lasting 364 days, from October 31, 1915) was made with two lots of 50 White Leghorn hens in their first laying year. These hens were fed a mash of ground maize, bran, meat scrap, and linseed oil meal (4:2:2:1). In addition Lot 1 received shelled maize, and Lot 2 wheat. The results are given in Table IX.

TABLE IX — *Comparative effects of maize and wheat (first experiment)*

Lot	Average number of hens per lot	Mortality %	Increase in weight per hen lb	Grain and mash consumed per hen lb	Eggs laid per hen	Food consumed per dozen eggs lb	Difference between cost of food and value of eggs \$
1	47.89	8	0.46	57.41	89.5	7.70	1.00
2	40.63	52	0.19	57.88	95.7	7.26	0.69

In a second experiment on the same subject four lots of 50 White Leghorn hens in their first laying year were fed for 364 days from November 26, 1916. The grain ration was composed of shelled maize for Lot 1, shel-

led maize and wheat in the ratio of 3 : 1 for Lot 2, shelled maize and wheat in the ratio for 1 : 2 of Lot 3, and wheat for Lot 4. The mash for each lot contained bran, meat scrap, and linseed oil meal (2 : 2 : 1) and, in addition, 4 parts of ground maize for Lot 1, 4 parts of a mixture of ground maize and wheat in the ratio of 2 : 1 for Lot 2, 4 parts of ground maize and wheat in the inverse ratio 1 : 2 for Lot 3, and 4 parts of ground wheat for Lot 4. After May 13, 1917, Lot 4 received the same ration as Lot. 1. Table X shows the results obtained in the two periods November 26, 1916 - May 12, 1917, and May 13 - November 24, 1917.

TABLE X. — *Comparative effects of maize and wheat (second experiment).*

Lot	Du- ration day	Average number of hens per lot	Mortality %	Increase (+) or loss (-) in weight per hen. lb.	Grain and mash consumed per hen lb.	Eggs laid per hen	Food consumed per dozen eggs lb.	Difference between cost of food and value of eggs \$
1	168	50.00	0	+ 0.04	26.65	56.9	5.62	0.91
2		49.80	2.0	+ 0.12	27.91	57.1	5.87	0.81
3		49.96	2.0	+ 0.20	27.67	57.7	5.75	0.77
4		44.33	42.0	+ 0.16	25.59	35.9	8.56	0.23
1	196	49.54	4.0	+ 0.31	27.53	41.4	7.97	0.45
2		48.46	4.1	+ 0.22	27.52	32.5	10.16	0.13
3		47.02	14.3	— 0.02	25.45	28.6	10.67	0.03
4		28.03	3.4	+ 0.50	26.09	32.0	9.77	0.25

An appendix gives a summary of the results obtained with 200 White Leghorn hens in their second laying season, at Clermont County Experiment Farm. The hens were all kept in one run opening on to a large field, of which they had the run. From October 28, 1915 to October 25, 1916, they each laid an average of 133.4 eggs, of a value of \$ 2.00 when the cost of food had been deducted. From October 26, 1916 to October 4, 1917, each hen laid an average of 103.5 eggs, of a value of \$ 1.17 when the cost of food had been deducted.

In this paper the cost of the rations is based on the following prices per 100 lb. (\$) :—

Shelled maize	2.00	Middlings	1.75
Ground maize	2.10	Linseed oil meal	2.25
Shelled wheat	3.00	Meat scrap	3.75
Ground wheat	3.10	Tankage	3.50
Shelled oats	1.75	Oyster shells	0.75
Bran	1.65	Griff	0.75

The cost of pasture is not included.

CULTURE

627 — **Observations on the Development and Reproduction of the Mulberry Silkworms.** — LÉCAILLON, A. — I. Reproduction et développement des bivoltins accidentels et de la première génération qui en dérive, in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXVIII, No. 7, pp. 366-368. — II Changements observés dans la reproduction et le développement des *Bombyx polyvoltins* de Chine transportés et élevés en France. *Ibid.*, Vol. CLXVIII, No. 10, pp. 529-531, Paris, February and March, 1919.

I. — The author has previously shown (1), that, in the mulberry silkworm, accidental bivoltins appear in univoltin breeds derived from eggs which, during their formation within the ovary, have undergone modifications which are manifested externally by a change of colour (white instead of yellow). Under these conditions the embryo develops much more rapidly (in 10 days instead of 10 months).

In this study the author has investigated the peculiarities shown in the development and reproduction of such bivoltins themselves and their direct descendants. As subjects he chose five pairs of accidental bivoltin moths born in August, 1917 which produced eggs from which the larvae emerged only in the spring of 1918. He found that the modifications occurring in eggs which give birth to accidental bivoltins (colour change) — are effaced, apparently at least, in the eggs laid by the bivoltin moths themselves. In April, 1918, these eggs gave birth to larvae which, in their turn, produced moths the immediate descendants of which showed very peculiar characters. An observation of the descendants of each of these five pairs showed that : —

1) Whereas, in typical univoltin breeds, there is but one kind of egg, there are two kinds in the silkworm producing two generations a year. The eggs differ from each other (colouration, peculiarities seen during embryonic development) according to the category to which they belong. One kind may be called *winter eggs*, the other, *summer eggs*, since one passes through a period of hibernation and only hatches in spring whereas the other hatches in summer, about ten days after it is laid.

2) When summer eggs appear in a univoltin breed, the accidental bivoltins which hatch from them do not transmit integrally and immediately to their progeny the capacity to produce alternately summer and winter eggs ; this capacity is only transmitted to a certain number of them.

II. — The author compared the reproduction and development of different varieties of silkworms by breeding side by side, under the same environmental conditions, polyvoltins from China, typical univoltins, accidental bivoltins and their progeny. The polyvoltins used belonged to the breed bred at the silkworm Breeding Station of Montpellier ; they had become bivoltin with a tendency to univoltinism.

The first pair of moths, from second 1917 generation cocoons, emerged on August 9 of the same year and produced exclusively winter eggs. These eggs began to hatch on April 25, 1918, producing larvae which gave birth to moths (first 1918 generation), all the eggs of which were summer eggs. The moths (second 1918 generation) from the summer eggs behaved differently as regards their direct descendants. Most of them laid win-

(1) See R. Jan., 1918, No. 75. (Ed.)

ter eggs, due to hatch in the spring of 1919, but a few pairs produced a second series of summer eggs, i. e. progeny which may be called accidental trivoltin, by analogy with the accidental bivoltins derived from univoltin breeds.

It is clear that the breeding of this third generation which must take place at a late period of the year, i. e., when the temperature is not sufficiently high, is very difficult. The copulation of the adults (born on November 12, 1918) becomes impossible, or, if it does occur, the eggs laid are not fertilised. The author was, however, able to obtain a certain number of eggs showing the customary characters of winter eggs by artificially maintaining several pairs of these moths at a sufficiently high temperature. These facts show that, in the climate of the south of France, only two generations of Chinese polyvoltins can develop each year, but certain moths of the second generation may produce a third generation, which can be fully raised by the use of artificial heating. In this breed there are also winter eggs and summer eggs, differing fundamentally by their chemical composition and the peculiarities which appear during the development of the embryo.

The author states that this conclusion may be extended to all bivoltin or polyvoltin breeds, the number of generations being capable of increasing, under the direct influence of the climate (up to a certain limit), in proportion as the production of new summer eggs can be advantageously repeated. This phenomenon may be reversed when polyvoltin breeds are reared in countries with colder climates.

628 - **Relation Between the Amount of Food Fed to Silkworms and the Size of the Cocoons.** — SASAKI CH JIRŌ, in the *Bulletin de l'Association sericole du Japon*, pp. 1-2 + 11 Figs. Tokyo, January 15, 1919.

During the two years 1917 and 1918 the author bred eleven different species of foreign silkworms in Japan (Brianza, Brianza Mari, Cévennes, Foresta Nera, Fossonbrone, Gran Sasso, Oro, Pyrénées, Roseo, Sierra, and Giallo Sferico breeds). During the 1917 season he suppressed one or two meals each day during the fifth stage, whereas in 1918 the larvae were given their meals of mulberry leaves without interruption. On comparing the two classes of cocoon some difference in size was noticed.

The numerous figures, given in table-form, show that the cocoons produced in 1917 were a little shorter and a little narrower than those of 1918. This applies especially to the cocoons of the Gran Sasso, Fossonbrone, and Sierra breeds, which were much shorter in 1917 than in 1918. There can, therefore, be no doubt that there must have been also differences in the silk-yield, but the author has not yet studied this subject. The experiments prove clearly that cocoons vary in size according to the amount of food the silkworms receive.

629 - **Relation Between the Hour at which the Mulberry Leaves are Picked and the Silk-Yield of the Silkworm.** — SACCHI, R., in *Informazioni seriche*, Year VI, No 6 pp. 61-63, Rome, March, 1919.

Leaves collected at the end of the day always contain more sugar and more proteins, formed during the day, than those picked at day-break

Leaves picked at day-break contain little of these compounds because, during the night, part of them undergo changes and leave the leaf for other organs of the plant.

The author studied the differences produced eventually in the development of silkworms and the quantity and the quality of their silk, by feeding them on : — A) mulberry leaves picked at day-break; B) leaves picked at sunset. All the conditions of vegetation, soil, climate, age of the plant, etc., were equal. In the spring of 1918 two groups of silkworms of the yellow Ascoli breed, each from 4 gm. of eggs, were fed A) on leaves picked toward 6 p. m. and kept in the dark on damp mats or cloths ; B) on leaves picked between 5 and 6 a. m. Hatching, the four moults, and mounting on broom, occurred on the same dates for both groups. In Group A the mortality was nil, in Group B there were only a few cases. The total weight of the cocoons was 24.266 lb. for Group A, and 23.102 lb. for group B. The weight of 500 cocoons was 2.653 lb. for Group A, and 2.512 lb. for Group B. The number of cocoons per lb. was 187 for Group A, and 198 for Group B.

Sericimetric tests made at the "Laboratorio di studi ed esperienze sulla seta" of Milan, on raw four-twist silk, gave the following results for the cocoons of each group :

	Group A	Group B
Average strength gm.	50.03	42.86
Fineness deniers	14.26	12.97
Strength per denier gm.	3.50	3.30
Elasticity mm.	245 60	260.73
Length of silk thread metres	888	884
Weight of silk thread gm	0.297	0.290
Fineness of silk thread deniers	3.05	2.92

In comparison with the silkworms of Group B, those fed on leaves picked in the evening, therefore, produced 9.213 lb. of cocoons more per ounce of eggs, and a better quality silk, except with respect to elasticity. It is, therefore, more profitable to both the breeder and the manufacturer, to pick the leaves in the evening than in the morning.

BREEDING

630 — **Fish Breeding in Rice Fields in Madagascar** (1). — LEGENDRE, J., in the *Revue agricole et vétérinaire de Madagascar et Dependencies*, Year III, No. 24, pp. 426-428. Tananarive, October, 1918.

The author, in a previous article (2), laid down the technique for rearing golden carp ("cyprin doré", "trondro gasy") in rice fields in the hope of inducing European owners of ricefields to take up this easy and paying form of fish breeding.

He now gives, among the results obtained by the natives during the last rice growing season, two results checked by him in the neighbourhood of Tananarive.

(1) See, by the same author, sent on a mission, *R.*, May 1917, No 472 and *R.*, November, 1918, No. 115 (Ed.).

(2) See *R.*, November, 1918, No. 1205. (Ed.)

1) A permanent ricefield, of about 0.3 hectares in area had been stocked in December, 1917, with 6 small baskets of carp of about 6 kg. in weight ; 9 months after, in August, 1918, 92 kg. of fish or about 16 times the stock, were obtained, in spite of the fact that the fishing, done with a movable barrier, according to the native custom, was incomplete, many fish remaining outside the barrier.

2) In another ricefield, of nearly the same area as the first, 2 kg. of carp were also placed in December, 1917 ; in September, 1918, the catch, made in the usual way, was 50 kg. of fish, or 25 times the amount put in. As a matter of fact the yield was higher, for, in June, the owner of the neighbouring ricefield, in which no carp had been placed, had a very good catch which, however, was not weighed (the fish had obtained entry through a breach in the bank of the ricefield).

The author quotes an experiment made by a colonist who, in December 1917 placed 300 carp 8 to 15 cm. long, with an estimated, and possibly exaggerated weight of 5 kg., in several rice plots with a total area of 0.5 hectare. After 5 months in the ricefields, from December, 1917, to the end of March 1918, a catch of 30 kg. of very fine fish, including a fairly large number of fry, was made.

The author states that stocking should not be too thin and that, stocked with a sufficient number of carp, including a fair number of "full" breeding fish, a hectare of ricefield should not yield less than 200 kg. of fish. Moreover, the excreta from such a large number of fish cannot but help the cereal by fertilising the soil.

The results of fish breeding in rice-fields are always good, but they can yet be much improved by careful selection of the fish used for stocking. The rice grower with large areas to stock would do well to keep fish of breeding age, as is the case with carp 8 cm. long (the caudal fin not included), in reservoirs 2 to 3 cubic metres in volume at the rate of 5 kg. per cubic metre. In these little aquaria, being crowded, they usually do not deposit their eggs or milt; they reproduce a few days after being placed in the rice-field and will give rise to many fry.

Not much liked by Europeans, the carp will be much esteemed by the native labourers, who will thus have an inducement to remain on the plantation.

For personal use, the European rice growers could breed the Malagasy or Marakelle perch, which does quite well in rice-fields and can live in water with a minimum depth of 10 cm. To avoid losing it in times of torrential rain, the bank of the rice-field should be high enough to be never submerged. The muddy taste acquired by the perch through living in the rice-field will disappear on keeping it a couple of weeks in a pond or marsh. To the contrary of the carp, it is unnecessary to put perch that are about to spawn into the rice-field ; 10 to 12 month-old fry or fish that have already spawned for that year should be used, or they will spawn in the ricefield and it will be difficult to collect the perch fry without causing the death of most of the fry that are not of an eatable size. After a stay of 4 to 5 months

in the ricefield, Marakelle perch from 5 to 9 cm. long (caudal fin not included) will have tripled in weight.

It would be worth while rearing both the carp and Malagasy perch in the same ricefield.

631 - **Trout Rearing in an Aquarium.** — JAKUES, in the *Bulletin Suisse de Pêche et de Pisciculture*, Year XX, No. 2, pp. 17-19. Neuchâtel, February, 1919.

Rainbow trout fry usually hatch at the beginning of May, at the moment when the water is too cold to have a rich food fauna. It is too late to put them to rear 5 or 6 weeks after hatching as their food sac is almost absorbed, because at that time they need to have become used to food. For this reason the author advises that they be taken, some 15 days after hatching, to small ponds which should be emptied in autumn, when the large beetles (*Dytiscus*, *Triton*) that prey on the young fish should be destroyed. If a pond is not available, the fry can be reared for some time in incubation tanks, but this method requires minute care: the excrement and surplus food must be removed daily and the walls of the tanks must be wiped once or twice a week to remove microscopic moulds, etc.; in this way, the appearance of the disease known as "costiase", so dangerous to young trout, will be avoided.

The author uses the aquaria of the Pervou establishment. A layer of clean sand, 3 to 4 cm. thick, is placed at the bottom of the aquarium. The fry are then introduced and, weighted down by their yolk sac sink to the bottom. A couple of days later, Daphnias are introduced, when the fry chase them actively. Before giving them fresh food, which is done twice a day, the dirt, excreta, etc., are all siphoned off, while the sand is thoroughly stirred and any dirt adhering to it is also siphoned off. After a certain time, *Tubifex*, placed on a plate suspended in the centre of the aquarium, are given for food as well as *Daphnia*; a few days later, when the fish are accustomed to their new food, they can be given anything: chopped meat, bread, mash, etc. The author placed 5000 trout fry in an aquarium measuring 90 × 60 × 40 cm. In September he took out 4697 young trout and placed them in the waters for which they were destined; the losses were, therefore, very small.

632 - **On the State of Breeding Salmon During their Spawning Migration into Fresh Water.** — ROULE, L., in the *Comptes Rendus de l'Académie des Sciences*, Vol. 167, No. 24, pp. 962-964. Paris, December, 1918.

As regards these salmon, the author has studied points relating to the age of individuals as well as those of the rhythm of the migrations and of sex. His researches, begun in 1911, have given results which correct and complete older work. For example, he found that the great majority of salmon (*Salmo salar* L.) that go up the streams, have previously spent two years in fresh water as fry; they then descend to the sea, live and grow there for a period varying from 2 to 5 years according to the individual; they return to fresh water to breed at the age of from 4 to 6 years.

Contrarily to the general opinion, most individuals only carry out a spawning migration once; out of all the fish observed only $\frac{1}{10}$ have carried out two successive migrations, and these were mostly males.

- 633 - **The Domestication of the African Elephant in the Belgian Congo.** — LÉPLAE, E., in the *Bulletin Agricole du Congo Belge*, Vol IX, Nos. 1-4, pp. 33-77 + 33 Figs. London, March-December, 1918.

OTHER LIVE
STOCK

Amongst the difficulties of all kinds that the Belgians have overcome in the Belgian Congo, the domestication of the African elephant will constitute one of the most striking episodes in the history of their colonial enterprise. The success of Belgian initiative in this work, which was previously thought impossible, has attracted general attention. But in Belgium they afterwards made the mistake of losing interest in the question, and of late it has even been proposed to suppress the training station on the grounds of economy. To help to avoid this coming true, the author (Director General at the Colonial Ministry) describes the different stages of domestication, the successes obtained at the Api station and their economic significance, in the hope of showing how much the work merits the support of the Belgian Government.

Until the war, the expenses of the Api station were met with the proceeds of the ivory obtained by hunting; since 1914, hunting has been suspended, and it is only since then that the Station has come on the colonial budget. But the expenses are only from 20 000 to 30 000 francs, a very small figure in comparison with the value of the enterprise and even of the market value of the Api herd whose 30 elephants are certainly worth 100 000 francs on the spot.

The author gives the history of the domestication of the elephant throughout the world from the earliest time to the present day, and describes attempts to utilise the Asiatic elephant in Africa, the capture and training of the African elephant at the Api station, founded by Commandant LAPLUME and his collaborators (M. VERMEESCH replaced Commandant LAPLUME during the war), and the utilisation of the elephant on the farm and in the forest.

- 634 - **Contribution to the Study of the Fauna of the Belgian Congo.** — See No. 576 of this Review.

FARM ENGINEERING

- 635 - **The New "Renault" Agricultural Tractor.** — *Le Génie Rural*, Year IX (New Series, Nos. 29-30), Nos. 89-90, p. 21 + 1 Fig. Paris.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

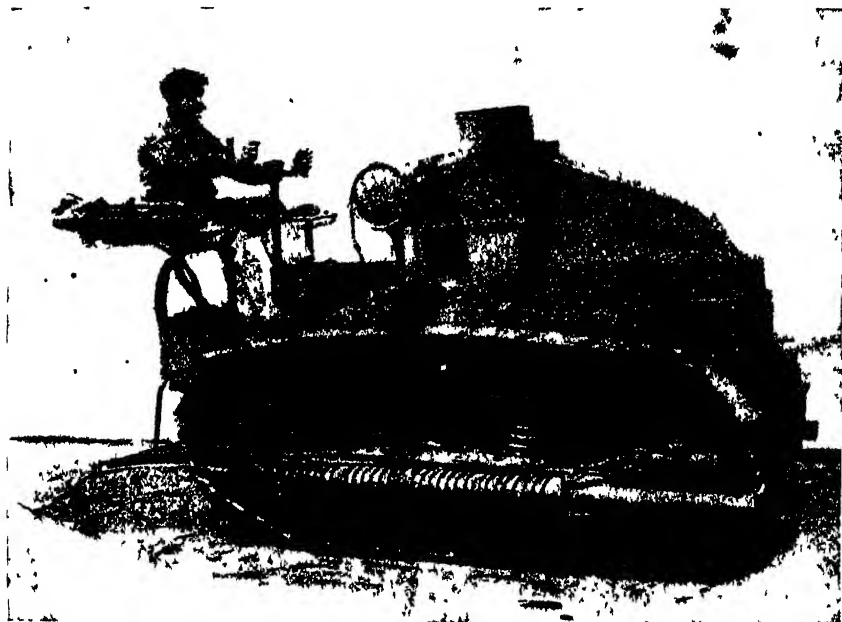
The RENAULT farm tractor is mounted on chain tracks that give it a very large surface of contact with the soil. The pressure per sq. centimetre is not more than about 400 gm., that is, a unit weight less than that of a man when walking.

The actual mechanical part of this tractor has been built in conformity with the results of experience in the construction of heavy motor vehicles.

The cooling is carried out on the thermosiphon system. The fan is fixed to the engine fly-wheel, thus avoiding the use of pulleys and transmission requiring frequent adjustment. Lubrication is automatic, the engine being supplied by a forced feed, the other parts working in oil baths. The reduction gearing is well worked out, and there are 4 speeds.

General characteristics of the RENAULT farm tractor :

<i>Engine</i>	35 H. P.
Dimensions of tractor	11 ft. 4 in. × 6 ft. 8 in.
First speed	4.921 ft. per hour
Second speed	9.843 " " "
Third speed	16.404 " " "
Fourth speed	22.966 " " "
Reverse	4.291 " " "
Bearing length of chain track	5 ft. 4 in.
Breadth of chain track	68 in.
Weight carried per sq. centimetre . .	0.392 kg.
Approximate total weight	5060 lb.
Normal draw-bar pull	3960 lb.
Draw-bar pull with overload	5500 lb.



Renault farm tractor

The tractor is steered from a wheel placed in front of the driver; it can be turned on the spot as well as in a large radius. It is easily controlled as turning is really carried out by the machine itself, one chain track run-

ing while the other is braked. The chain track consists of large steel links, running on strong axles. The links are designed in such a way as to give great adherence, which not damaging the soil in any way.

By means of rollers and a device for tightening the chain up easily, the load can be quite evenly distributed.

Owing to the design of the chain track the tractor moves forward in in such a straight line, that the driver can easily leave his seat when moving in a straight line, so that he has can see that the ploughing is being properly done.

The haulage attachment is fixed at the level of the chain track wheels at about 16 in. above the soil. Its design is such as to avoid any movement of the tractor to either side when the number of shares in the gang is increased or diminished. In normal work the draw-bar pull is about 1800 kg.

The maker states that, under normal conditions, and drawing a 4 or 5-furrow plough, the tractor can plough from 6 to 12 in. deep in good soil, while the most difficult soils can be turned up by reducing the number of shares or ploughing more shallowly.

636 - **Journeys Made by Tractors.** — DESBRISSAIS, R., in the *Journal d'Agriculture pratique*, Year LXXI, Vol. XXXI, No. 18, pp. 354-355. Paris, September 4, 1918.

The author deals with a communication made by M. A. GOUILLON (Director of the Fontaines School of Agriculture) to the "Union agricole et viticole" of Châlons-sur-Saône, on the journeys made by tractors in going from field to field.

The tractor should move distance under 5 kilometers under its own power. For distances of 5 to 10 km., however, it should be drawn by a team, only using its own power to get up steep hills. For distances of 10 to 30 km., it is best to carry the tractor on a motor lorry. Above 30 km., it should be carried by rail.

637 - **Harvesting with a Tractor** (1). — PLUCHET, E., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 30, pp. 830-838. Paris, October 9, 1918.

The author gives information on the harvest work with tractors that he carried out at Trappes (Seine et Oise) as well as that done by trustworthy farmers.

At Trappes, a 10-20 H. P. Titan tractor worked with difficulty in some strong winter wheat; it had to run free on one and sometimes two sides; in 10 hours it harvested 24.7 acres with a consumption of 14.2 pints of paraffin, 1.8 lb. of oil and 0.26 lb. of grease per acre. In a less heavy crop (spring wheat, oats), the same machine cut 11.1 acres, with a consumption of 9.8 pints of paraffin and 2.2 lb. of oil per acre. On another farm (Eure) a Titan hauling a MacCormick binder cutting a width of 6ft. 11in. cut nearly 15 acres a day, consuming 10.6 pints of paraffin per acre (a crop of average weight).

An Emerson tractor with a Massey-Harris cutting a 6ft 3 in. swathe, cut 10 acres a day, using 8.5 pints of petrol per acre.

(1) For further information, see R, December, 1918, No. 1400. (Ed.)

At Voisins-le-Bietonneux, a Case tractor hauling a 6 ft. 11 in. Deering, cut 8.6 acres a day using 11.4 pints of petrol per acre ; on a slight slope the tractor could barely reach a speed of 1.7 miles per hour — the minimum speed required for a harvester cutting a heavy crop.

At Manet (Trappes), a Case drawing 2 binders, one cutting 36 in., the other 59 in., cut as much as 32.1 acres in a day (average oats) ; it cut 2.20 acres in an hour, with a consumption of 17.6 pints of petrol and 1.1 lb. of oil.

At Troumoreau (Villepreux), a large Case tractor, drawing two 6 ft. Mac Cormick binders, cut an average of 17.4 acres a day (wheat and oats), consuming 7.2 pints of petrol per acre.

Judging from experiments in applying power to harvest work, the tractor seems specially suitable for cereal crops whether important or not, as the tractor is particularly indicated for light work that requires to be done quickly.

638 — **Progress in the Utilisation of Wind Engines.** — BLIN, H., in *La Nature*, No. 2352, pp. 268-269 Paris, February 22, 1919

The utilisation of the wind as motive power for driving electric dynamos is of considerable interest. Up to the present the problem of associating the dynamo with wind engines has depended on the suppression of the pulleys and gears that complicate both machines and make them lose their natural qualities of simplicity and flexibility. M. P. FAYARD DE MILLIE has found out how to do away with these troublesome intermediaries between the wind engine and dynamo ; as the dynamo usually has to rotate 100 times more quickly than a wind engine of the same power, a special type of dynamo has had to be used, while the structure of the wind engine has had to be greatly modified so that both machines can run at the same speed. By using a multipolar dynamo the speed of rotation can be reduced within a certain limit controlled by weight, yield and economy. What remains to be done, therefore, is to speed up the wind engine while improving its construction from the point of view of smooth running, strength and yield.

The power of a wind-engine fan wheel is proportional to its surface, which again is proportional to the square of its radius ; but its speed of rotation is inversely proportional to its radius. Therefore, to increase the speed without reducing the surface, the only thing to do is to diminish the radius and increase the number of fan wheels, while losing none of the wind's motive power.

M. FAYARD DE MILLIE's experimental researches have shown that by keying the induction of the dynamo directly on the axle of a wind engine with 6 suitably spaced fan wheels, an aero-electric apparatus is obtained which is satisfactory as regards yield, smooth working and safety, and which charges small accumulators perfectly with the aid of an automatic make-and-break.

A wind engine with 6 fan wheels instead of one, so as to obtain the same working surface, has a smaller diameter and therefore escapes to a large extent the "law of cubes", in the ratio $\frac{\sqrt[3]{6}}{\sqrt[3]{1}} = 2.449$. It is more econo-

mical, stronger, easier to control and runs more regularly, on account of the incessant variability of the air currents in too small an area.

A machine of practical size with an area of 10 sq. metres with fan wheels 1.6 metres in diameter, given a moderate wind with a velocity of 5 to 10 metres per second, will yield 5 to 20 hectowatt with a 6-pole dynamo with a efficiency of 0.66.

639 - **Review of Patents.** — *Sources*: CANADA, DENMARK, UNITED STATES, NEW ZEALAND, HOLLAND, UNITED KINGDOM, see R., January, 1919, No. 114. — FRANCE, see R., February 1919, No. 247. — INDIA, *The Indian and Eastern Engineer*, Calcutta.

TILLAGE MACHINES AND IMPLEMENTS. - *Canada*: 189157-189173 Hoes; 189513 Harrow.

Denmark: 24181 Motorplough; 24309 Gang-lifting device for a motor tillage machine.

France: 488443 Motor plough; 488501-489313 Ploughing machines; 488589 Windlass for a ploughing set; 488793 Improvements to mechanical harrows, cultivators, etc.; 488946-488947-488948 Improvements to ploughs; 489086 Improved plough with oscillating socks and cutters; 489220 Automobile plough; 48923 Motor tillage machine for vineyards; 489370 Combined roller and herse for haulage by animals; 489448 Cultivator with a vertical digging action; 489478 Rotary digger, 489582-489853 Ploughs; 489627 Tractor for uncovering and earthing-up vines; 48978c Improvements to motor tillage machines, particularly automobile ploughs; 489785 Improvements in the construction of brabant ploughs; 489887 Tractor for vineyards; 489977 Device for a vineyard cultivator with a vertical digging action and automatic clearance; 489998 Windlass for mixed ploughing; 490016 Rotary plough; 490125 Tractors and devices for stirring the earth such as cultivators, ploughs, etc.; 490205 Improvements to wheel harrows.

New Zealand: 39586 Plough for digging-in weeds; 41060 Cultivator; 41113 Device for lifting plough bodies and regulating the depth of ploughing.

United Kingdom: 12226 System of cable traction for ploughs; 122476-122713-123131-123164 Motor ploughs; 122744 Small plough for human or animal traction; 123134 Improvements to ploughs, cultivators, etc.; 123257 Improvements to mechanical traction ploughs.

United States: 1290446 Cultivator for lucerne fields; 1293146-1293769-1294086-1294580-1294769-1295253-1295731 Cultivators; 1293353 Harrow; 1293714 Motorplough; 1293876-1294902 Gang ploughs; 1294860 Device for fixing a gang plough to the beam; 1295127 Device for regulating the height of a gang plough; 1295242 Motor plough; 1295525 Motor cultivator; 1295545 Plough; 1295948 Multiple balance tractor plough; 1295990 Shaft and multiple whipple-tree for a harrow; 1296239-1296266 Lifting device for multiple ploughs; 1296081 Multiple plough with fore wheels.

DRAINAGE AND IRRIGATION. — *Denmark*: 24219 Ditching machine.

MANURE AND MANURE DISTRIBUTORS. — *New Zealand*: 40311 Fertiliser composed of equal weights of finely ground coke, carbonate of lime and mineral phosphate.

United Kingdom: 122048 Process for making potassium chloride; 122897 Process for purifying superphosphates; 122902 Fertiliser composed of ammonium sulphate and phosphate to which may be added degelatinised bone powder or precipitated phosphate; 123177 Phosphatic slag obtained by adding ground phosphorites to lignites or other mineral coal for the production of lighting gas; 123337 Process and plant for the manufacture of ammonium sulphate.

United States: 1293229 Manure loader; 1293281 Fertiliser distributor.

DRILLS AND SEEDING MACHINES. — *Denmark*: 24166 Beet seed drill; 24180 Plough with potato planter attached.

France: 488626 Improvements in broadcast sowers.

United Kingdom: 122444 Machine for drilling seeds and fertilisers in pastures with previous preparation of the soil; 122933 Hand potato planter; 123456 Hand planter.

United States: 1290103-1294629 Maize sowers; 1293092-1296540 Sower hoppers; 1295057 Hand-worked sower for maize and kidney beans; 1295845 Beet seed drill; 1296255 Potato planter.

VARIOUS CULTURAL OPERATIONS — *Canada*: 189157-189173 Hoes.

Denmark: 24125 Watering machine.

France: 489243 Motor tillage machine for vineyards; 489627 Tractor for uncovering and earthing-up vines; 489977 Device for a vineyard cultivator with a vertical digging action and automatic clearance.

New Zealand: 39586 Plough for digging-in weeds.

United States: 1290446 Cultivator for lucerne fields; 1293745-1296153 Weeders; 1294259 Cotton thinner; 1295242 Motor hoe.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *France*: 489066 Spraying nozzle enabling the under sides of the leaves to be reached easily; 490228 Collar protecting trees against ants; 490231 Traction sulphuring machine; 490232 Traction sulphating machine.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada*: 188927-188933 Shocking machines; 189068 Flax getter; 189127 Harvester; 189168 Mower; 189293 Machine for lifting vegetables.

United States: 1293583-1295254 Maize harvester; 1293922-1295271 Shocking machines; 1294233-1294822 Machine hay rakes; 1294898-1295822 Kidney bean harvesters; 1295331 Sugar cane harvester.

MACHINES FOR LIFTING ROOT CROPS. — *Denmark*: 24072 Adjustable stay for plough, potato lifter, etc.

France: 489991 Machine for lifting and topping beets, shaking the earth off them, and placing them on one side.

United States: 1290490 Groundnut lifting plough; 1293144-1293170 Groundnut harvester; 1293632-1294801-1295340 Beet harvester; 1295591-1296475 Potato harvester.

THRESHING AND WINNOWING MACHINES. — *Canada*: 188965 Sorter; 189229 Binding-cutter and feed for threshing machine.

Denmark: 24315 Aspirator-transporter for threshing machines and the like.

United States: 1290610 Threshing machine; 1294030 Sorter.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *France* : 488510 Farm dryer; 489173 Machine for making bundles.

Holland : 3030 Machine for cleaning Corinthian raisins and other small fruit.

United States : 1290364 Hay elevator; 1293517-1295520 Hay loaders.

FORESTRY. — *France* : Hydraulic machine for splitting and drawing stamps.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *France* : 486496-488633-488698 Farm tractors; 488357 Motor tractor for farm use, etc.; 488542 Farm tractor that can be used for road transport and as a domestic motor on the farm; 488589 Windlass for ploughing tackle; 488786 New system of farm tractor; 489869 Device for giving tractors greater grip on the soil; 489998 Windlass for mixed ploughing.

United Kingdom : 122226 Cable traction for plough.

United States : 1290347-1290475-1290748 1293541-1293815-1293999-1294748-1294819-1296022 Tractors; 1296027 Automatic mechanism for steering and controlling tractors.

FEEDING AND HOUSING OF LIVESTOCK. — *France* : 490215 Cattle cake made from dead leaves.

New Zealand : 39830 Concentrated food for calves.

United Kingdom : 123481 Pig trough; 123485 Trough for pigs and other small animals.

POULTRY FARMING. — *France* : 490247 Incubator.

United Kingdom : 122965 Chicken pen, 123485 Drinking and feeding trough for poultry.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *France* : 488510 Farm dryer

Holland : 3030 Machine for cleaning Corinthian raisins and other small fruit.

United Kingdom : 122422 Process for drying potatoes, tubers and roots cut into small pieces.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *France* : 489817 Process for destroying insects, worms, larvae, eggs, etc., in skins, wool, cloth, furniture, etc.

DAIRYING. — *Canada* : 189133 189327 Milking machine; 189471 Teat-cup for milking machine; 189517 Separator.

India : 4164 Improvements in machines for cooling butter.

New Zealand : 40711 Process and apparatus for preparing milk powder.

United Kingdom : 122578 Milking machine; 122749-123380 Milk churns; 122857 Teat cup for milking machine.

RURAL ECONOMICS.

640 — **On the Economics of Manuring.** — MAFENGHI, E., in the *Giornale dei Economisti e Rivista di Statistica*, Vol. LVI, No. 5, pp. 268-276. Rome, May, 1918.

I. THE PRACTICE OF MANURING. — It has not always had, and has not everywhere the same economic importance. In remote times when the

scanty population lead a pastoral life, animal excreta were valueless and were a burden to stock breeding. The economic importance of manure begins and gradually increases with development of the population and the resulting exhaustion of the soil.

In countries with an old civilisation, the most intensive systems of agriculture needed, before the use of fertilisers became general, a great number of livestock, so as to maintain the fertility of the soil. It was then that manure was defined as a *necessary evil*. But later, the discoveries of LIEBIG and others led to the foundation of the fertiliser industry, which now must be considered as one of the chief factors of agricultural production. According to figures published by the INTERNATIONAL INSTITUTE OF AGRICULTURE, the world's consumption of chemical fertilisers amounts to the value of over 10 milliards of francs.

II. CHIEF FACTORS DETERMINING THE USE OF FERTILISERS. -- The use of fertilisers is, in each case, a function of multiple factors that the author divides into two fundamental groups :

1) of an objective order, which is related to the economic, technical and physical conditions of the environment ;

2) of a subjective order, which concerns the psychology of each farmer.

Amongst the factors of the first group the author cites circumstances of an economic nature relating to land values, the cost of fertilisers, the prices of agricultural products, etc. He states that some of these circumstances depend one on the other.

In localities where land is dear, it is economically advisable to push the degree of cultural intensity to a high level by making use of, among other means, an abundance of manuring, as is shown by the statistics relating to the consumption of chemical fertilisers in all parts of the world. The author takes, as an example, the consumption of nitrate of soda, of which three-quarters of the total production are absorbed by Europe, where land values are generally much higher.

The opportunity of using fertilisers is, *proso modo*, in inverse ratio to their price and in direct ratio to the price of agricultural products. The cost of fertilisers is also a function of the cost of transport which, in this respect, places farms in the hill districts in a less favourable condition.

As regards the technical and physical circumstances the opportunity for the use of manures depends largely on their effects on the yield which, other things being equal, varies greatly in each case, according to the soil, climate and other causes. The author gives figures showing the average unitary consumption of fertilisers in the north of Italy and he states that the difference in consumption can be partly explained by the rare and bad distribution of the rainfall in the south (the action of the fertilisers being rendered somewhat more feeble than in the north).

The economic psychology of farmers, whose evolution is not yet sufficient everywhere to take into account as ought to be done the importance of fertilisers and their adequate use, is notably and progressively developing in Italy, as is shown by the consumption of fertilisers which, from 100 in the period 1871-1880, passed to 1478 in the period 1901-1910.

The author shows, with the help of statistical data relating to the imports of fertilisers into Italy for the last few years the regressive form assumed by the phenomenon during the period of the war; he says that the exception constituted by nitrate of soda can be explained by the consumption of this product for the manufacture of explosives.

III. BALANCE OF THE FERTILITY OF THE SOIL. — Crops remove from the soil considerable quantities of nitrogen, phosphorus and potash which constitute the most important fertilising principles. Part of these elements leaves the farm with the sale of various products, while the rest returns to the soil, mostly in the form of manure. The author considers the balance of fertilising elements from the point of view of general economics and points out that the balance of nitrogen has special characteristics, for it is not determined solely by the *importation* and exportation, but by other causes also, some of which act favourably (nitrifying bacteria, electric discharges, fixation of atmospheric nitrogen by leguminous plants, etc.), others unfavourably (denitrifying bacteria), while the balance of potash and phosphorus is controlled by the importation and exportation alone, although these two elements have a very different economic importance. In fact, potash has a *decided interior circulation*, because it has a tendency to concentrate in straw and hay, which return, in great part, to the soil with manure and often under a more assimilable form. On the contrary, phosphorus, of which soils have usually a very poor content, is mostly exported from the farm, chiefly in the form of cereals and animal products. In contrast with the exhaustible deposits of nitrates (*caliche*), potash salts and phosphorites, the author places, as possible and inexhaustible future sources of these fertilising principles, atmospheric nitrogen, sea water and bones.

IV. FUNDAMENTAL ECONOMIC PROBLEMS. — The fundamental economic problems relating to the use of fertilising material consist in the *choice* and *suitable limits*.

If it is admitted that it is worth while using manures, which becomes evident when the value of the increase in yield is greater than the relative expenses, we have to face the problem of *choice* which, as regards technical conditions, is subordinated to the different requirements of the crops and which, as regards economic conditions, is subordinated to the *law of minimums* or of *definite proportions*, according to which *the elements of fertility are utilised in a proportion which is practically constant for each crop*.

From this law the following deductions can be made:

- 1) If one of the fertilising elements is present in relatively greater quantity than the others, it remains partly unutilised;
- 2) the yield from the soil depends, other things being equal, on the factor which is present in the smallest relative quantity.

According to the author the theory of *integral restitution* cannot be accepted from the economic point of view. In fact, taking as an example, a soil very rich in potash, but poor in phosphorus and nitrogen, with a manuring based on an *integral restitution*, each year this manuring costs a fixed sum s_1 superior to the expense s_2 due to manuring on a basis of *partial restitution* and consequently, for example, in the case under consideration, to

phosphorus and nitrogen. Now, if the excess of potash in the soil, as regards crop requirements, is such that it can suffice for t years, by carrying out *partial restitution*, we obtain a total economic advance V given by the following formula: $V = d \frac{(1+r)^2 - 1}{r(1+r)^t}$, where r is the rate of interest and d the difference $s_1 - s_2$. If no profit is made from this circumstance, the potash reserve is considered as realisable in an infinite number of years and, consequently, of no actual value. It also follows that, in allowing n years to pass before utilising it, its value becomes reduced to $\frac{V}{(1+r)^n}$; or, in other terms, it is so much higher as its utilisation is more prompt.

If the problem of the need for manuring is considered, the author states that chemical analysis of the soil can only furnish somewhat vague information in this respect, and that it may be said that the theory of *agricultural statics* has now been completely abandoned, being replaced by suitable manurial experiments, which are often more instructive. But he thinks that:—1) it is now certain that phosphatic manures are suitable practically everywhere; 2) potassic manures can only be used suitably under certain fixed circumstances: light soils, crops elaborating large quantities of starch, sugar, cellulose, etc.; 3) nitrogenous manures give the best economic results in soils poor in organic matter (which are easily recognised) or in other simple cases that need not be mentioned.

The author thus tackles the very important economic problem of the *limit of economic suitability*, which is determined by the fact that progressive amounts of fertilisers give rise to yields that gradually decrease, following a curve whose position varies in each case as a function of numerous factors: climate, soil, etc.

To provide a strict solution of this problem, the author thinks that the *limit where marginal expenses and yield are equal* must be reached under the simple circumstances of practice, when the respective form of the curve will be known. A good method for ascertaining this consists in carrying manurial experiments with progressive amounts of the element the productivity of which has to be studied.

WAGNER estimates that, within the limits where a greater amount of fertiliser produces an increase in yield, there is a direct proportion between the former and the latter.

In more exact and analytical terms, in representing a series of homogeneous groups of plots by $g_1 - g_2 - g_3 \dots$, the progressive amounts of fertiliser used by $q_1 - q_2 - q_3 \dots$, and the corresponding unit yield by $p_1 - p_2 - p_3 \dots$, according to WAGNER the increase in yield (m) per unit of fertiliser would be given by the following formula:—

$$m = \frac{(p_2 - p_1) + (p_3 - p_2) + \dots}{q_1 + q_2 + q_3 + \dots}$$

An increase in yield of mx would, therefore, correspond to a quantity x of fertiliser, but the author points out that this formula is only a feeble approximation to the truth.

According to the author, MITSCHERLICH'S hypothesis is much more strict; he admits that the *quickness of increase in the production* in relation to any particular biological factor, including the fertiliser, is proportional to that which is lacking to reach the limit of saturation. This hypothesis is expressed

by the differential equation $\frac{dy}{dx} = (A - y) K$, where A represents the

maximum yield that can be obtained by reaching the limit of saturation, x the quantity of fertiliser used, y the relative yield, K a constant that varies in each case. The values of A and K can be found by means of manurial experiments. From this general formula can be deduced an interpolation formula which, according to the author, represents the facts more truly than that of WAGNER, as has been shown by numerous applications made of it (cf. A. GRÉGOIRE, *Les Recherches agronomiques et l'interprétation de leurs résultats*, extracted from the *Annales de Gembloux*, 1912, p. 71. Brussels, 1913).

But no matter in which way the phenomenon proceeds, the problem cannot be solved as regards the economics of the farm save by intuition; the author says this is a method that is more often right than is generally supposed.

The quantities of fertilisers used in practice are, according to the author, a little less than the limit of economic suitability, owing either to ignorance, lack of means, or even to a mistaken spirit of economy.

But, even where these factors do not exercise their negative action, as happens in the most developed agricultural countries, the desired end is not fully attained. And the error does not solely depend on the judgement, which is necessarily approximate, regarding the productivity of fertilisers, but also on the tendency to use quantities expressed in *round figures*, such as 2, 3, 4... cwt. per acre. These considerations hold good for fertilisers bought outside the farm, and of which any desired quantity can be used, but this does not apply to farmyard manure, the production of which is determined in practice by the organisation of stock rearing, as, generally speaking, stock can produce 25 to 30 cwt. of manure per cwt. of live weight, horses and sheep coming near the minimum limit and cattle near the maximum limit.

The economic problem of farmyard manure takes the following form: to distribute the manure between the different crops in such a way as to obtain the maximum useful effect, which can be done when the respective marginal yields are equal. In practice such a distribution can only be based on experience.

The importance of manure in the economy of the farm depends on its transformation value, which in turn depends, in each case, on the nature of the soil, on the quantity given per hectare, on the crops that utilise it, on the price of the products of the soil and also, in places where chemical fertilisers are used, on their cost. The author remarks, as regards this point, that the transformation value of farmyard manure and in general, of all fertilisers, depends, among other things, as has already been said, on the quantity employed per unit of area; other things being equal, as the quantity

is increased the corresponding effect, that is, the transformation value, decreases. And, as in those places where fertilisers are used, the amounts applied tend to reach the economic limit at which expenses and marginal yields are equal, it precisely follows that the value of the chief fertilising principles (phosphorus, nitrogen, etc.) should oscillate between the respective marked prices.

V. VALUATION AND PURCHASE OF FERTILISERS. — The value of a manure is a function of its *content* of useful principles (nitrogen, phosphoric acid, potash) and of its unit value which in turn depends on the way in which the manure is combined and on other circumstances.

The author briefly analyses the terms of the question stated above, including frauds relating to the *content* and *form of combination*, against which many in Italy demand a special law for the control of the raw materials used in agriculture; in practice, the question of frauds is solved in most cases by purchases in common made by agricultural societies.

AGRICULTURAL INDUSTRIES.

INDUSTRIES DEPENDING ON PLANT PRODUCTS

641 - Vine-Shoots Ensilaged after the Vintage as a Source of Alcohol and Tartaric Acid. — VENTRE, in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. V, No. 9, pp. 334-340. Paris, March, 1919.

The ensilage of vine-sheets immediately after the vintage (1) is an agricultural operation that is spreading more and more owing to the lack of fodder. The vine-shoots are carefully pounded till they become like moss; this is placed in water-tight vats and pressed down until the density of the mass is about 0.8. The vat is covered with a layer of straw, followed by earth which is beaten down. The shoots soon heat up, rapidly reaching 50 or 60°C. The heating is accompanied by the formation of much gas; after 6 or 7 weeks, the temperature decreases, becoming normal, when the shoots can be used as fodder.

Noticing the strongly vinous odour of the vats when opened, the author wished to find out how much alcohol was produced during ensilage. The shoots were distilled with water in a DEROY retort. The following quantities of alcohol per 100 gm. dry matter were obtained on various dates — *Shoots of 1917*: April 2, 1.65; April 16, 1.60; May 21, 1.45; June 11, 1.35; July 20, 1.25; October 10, 1.50.

The wood yields much more alcohol than the leaves, which is quite easy to understand, as taking equal weights the leaves contain more water. The liquid obtained by distillation contains only traces of water. The composition of the alcohol is: ethyl alcohol, 94.8%; methyl alcohol, 5.1%.

The origin of the alcohol produced in the shoots during ensilage is purely physiological and is due to the condition of asphyxia in which the leaves are kept (intracellular fermentation). Any bacterial fermentation must be excluded, as the action of the yeasts is annulled by the high temperature and the absence of an important amount of volatile acid in the dis-

(1) See R. October 1918, No. 1135. (Ed.)

tillate shows the non-existence of a lactic fermentation that might eventually adapt itself to the high temperature produced.

As the mother-liquor of the distillation had an acid reaction and deposited abundant crystals on concentration, the author examined it and found that the crystals consisted of tartaric acid, some 225 gm. of this acid being present per 100 gm. of raw material. The author then treated ensilaged shoots that had not been distilled with 4 % hydrochloric acid, thus applying the industrial method for the extraction of tartaric acid from grape residue. The results showed that the woody parts contained less than the leaves. In order to ascertain whether the tartaric acid content remained constant, even when growth was stopped, the author carried out a series of tests on shoots immediately after the vintage; the tests were continued until the leaves began to fall and those for the shoots were continued for about a month after. The results showed that the tartaric acid content of the leaves had decreased by nearly 45 % between the moment when, just after the vintage time, the vine continued to grow and that when the first cold brought about the fall of the leaves. The depletion of the woody parts is much more rapid (70 %) during the same period, which tends to show that, under the action of the reflux of sap, the cells are partly emptied, allowing the tartaric acid salts to diffuse.

642 - **Utilisation of the Root of Wild Chervil (*Anthriscus sylvestris*).** — COLIN, H., in the *Bulletin de l'Association des Chimistes de Sucrierie et de Distillerie*, Vol. XXXV, Nos. 10-12, pp. 106-107. Paris, April, May-June, 1918.

The author has studied a wild Umbelliferous plant, very common in wooded parks, known as wild chervil (*Anthriscus sylvestris*), whose root contains a fair amount of crystallisable sugar and starch. The average results of several analyses are, per 100 gm. of fresh material:— reducing, 0.96 gm; saccharose, 5.64 gm.; starch, 14.50. The root has a pronounced odour of wild carrot accompanied by a disagreeable poisonous odour, but neither of these smells comes from any toxic substance; stock, however, refuse the root.

The root of chervil seems most suitable for the production of alcohol; nearly all the sugar can be extracted with water; the starch would then be treated by one of the usual processes. The author has made sure that the odorous substances do not interfere with the development of the yeast. *Anthriscus* is a biennial plant; it should be gathered at the end of the first period of growth, for it then contains most carbohydrates; at the beginning of the next year, the plant begins to form seed and the root empties.

643 - **Industrial Residues from the Oil-bearing Seeds of the Family Meliaceae and their possible Agricultural Utilisation.** — LECOQ, R., in the *Bulletin de la Société de Pharmacie*, Vol. XXV, Nos. 5-6, p. 156. Paris, 1918. Summarised in the *Annales des Falsifications et Fraudes*, Year XI, Nos. 121-122, p. 394. Paris, November-December, 1918.

The author, after studying various cakes made from exotic oil-bearing seeds found those of *Agadirachta indica* (decorticated: 5 % of nitrogen) and *Trichilia emetica* (4 % of nitrogen) of special interest to agriculture. Next come those of the African *Carapa* (decorticated: 3-4 % of nitrogen),

then, at the bottom of the list, those of *Amoora Rohituka* (2.5-2.75 % of nitrogen) and *Carapa guianensis* (1-1.3 % of nitrogen).

The author would like to see the seeds of the chief colonial species better utilised, for they are doubly valuable : for soap and stearin manufacture on account of their oil and for agriculture on account of the residue left after extraction

- 644 - **Methods for Preventing Vegetable Margarine from turning Rancid.** — JACOBSEN, H. C., in *Folia Microbiologica*, Vol. V, pp. 94-902, 1918. Summarised by MOUTON, H., in the *Bulletin de l'Institut Pasteur, Revues et Analyses*, Vol. XVII, No. 6, p. 208. Paris, March, 1919.

At the present day, large quantities of margarine are made from coconut, palm and other oils. This margarine, like butter, is liable to become rancid owing to the action of microorganisms, especially in hot weather. Cultures of the bacteria isolated, grown on emulsions of vegetable oils with agar, have shown the action of moulds, amongst which *Penicillium glaucum* and *Cladosporium butyri* play the principal part. The odour given off in cultures by these organisms is just like that of natural rancidity. Now water, even in very small amounts (2 to 5 per 1000), is indispensable for the growth of these organisms and, consequently of the production of rancidity. Vegetable margarine can, therefore, be prevented from going rancid by adding antiseptics that will dissolve in the drops of water contained in the margarine, the quantity used depending on the total water content. That of the commercial product, often as much as 14 %, would require from 2.5-3 % of sea salt, but this quantity is too much for human food. So only 2 % of salt can be used, together with 2 per 1000 of sodium benzoate or 0.75 per 1000 of benzoic acid. The margarine can be kept at least 5 weeks by adding 2 % of sea salt + 4 per 1000 of borax + 2 per 1000 of boric acid.

INDUSTRIES
DEPENDING
ON ANIMAL
PRODUCTS

- 645 - **Cholesterol in Milk.** — DENIS, W. and MINOT, A. S., in the *Journal of Biological Chemistry*, Vol. XXXVI, No. 1, pp. 59-61 + 2 Tables, Baltimore, October, 1918.

Numerous determinations of the cholesterol in healthy and diseased human and animal blood have been made but the investigations have not yet been extended to other organic liquids or the products of secretion, especially milk. The authors, therefore determined the cholesterol content of several samples of fresh milk by BLOOR'S colorimetric method, determining at the same time the fat content by the Babcock method. The results show that variations in the cholesterol content of cow's milk are in proportion to those of its fat content. The cholesterol content of the samples analysed varied from 10.5 mgm. to 17.6 mgm. per 100 cc.

The effect of the cholesterol content of food on that of the blood has often been shown. It, therefore, seems probable that the ingestion of cholesterol in the food must increase the cholesterol content of milk. This hypothesis also seems to be confirmed by the fact that the determination of the cholesterol content of several samples of human milk showed that, as a rule, this content is higher in such milk (up to 38 mgm. per 100 cc.) than in cow's milk. This is probably due to the higher cholesterol content of the diet of nursing mothers.

646 - **The Slaughtering Yield of Cattle, Goats and Sheep in Italian Somaliland.** — CROVERI, P., in the *Rivista del Freddo*, Year V, No. 3, pp. 92-97 + 4 Figs. Rome, March, 1919.

EXPERIMENTS WITH CATTLE. — These were made with 16 animals bought in the Merca and Audegle markets and coming from different parts of the colony. They were slaughtered during the dry season (December 15-March 15). Many animals in Somaliland belong to the Giddu breed. The animals were in mediocre condition, which may be taken as normal for the dry season. The following data were obtained:—

Average yield on slaughtering (16 beasts) in % of the live weight	54.64
Yield of cattle of the Giddu breed and its crosses	53.29
" " " " Gherra breed	56.20
" " " " Boran breed	56.58
" " " under 3 ½ years	53.28
" " " over 3 ½ years	55.54
" " bulls and bull-calves	50.91
" " bullocks	56.20
" " cows	56.77

The slaughtering yield is thus fairly high. The live weight, after fasting 12 hours, varies between 145-360 kg. (319-770 lb.). The only by-product utilised at present in the colony is the skin, though the fat is sometimes made use of. The author has been able to dry the blood perfectly in the sun, without any trace of putrefaction, but care must be taken to break up the clots.

The skin loses 60 % of its weight on drying. The weight of the fresh skin (average of 16 cattle) varied between 14 and 27.5 kg. The price of the meat was 16 centimes per kg. for animals bought directly from the herds and 23 centimes per kg. for animals bought from butchers in Merca. This price includes the market value of the skin in Merca, but no account has been taken of the fat and other by-products, which, were the trade better organised, might become valuable. Thus the organisation of a slaughtering industry with the object of supplying the home country with preserved or frozen meat would probably pay well.

EXPERIMENTS WITH GOATS. - In spite of the scarcity of pastures these animals were in good condition, thus showing that they are well adapted to their environment. Animals slaughtered, 30; average yield, 49.91 %; yield of entire males, 51.33 %; yield of females, 49.12 %. Skin of good quality, weighing about 5 kg.; excellent meat, free from the characteristic goatly smell.

EXPERIMENTS WITH SHEEP. — Average yield of 13 animals, 41.86 %; males, 45.2 %; females, 38.95 %. Excellent meat; the accumulation of fat at the base of the tail is much appreciated.

CAMEL MEAT. — The natives prefer camel meat; if this meat began to be consumed generally in Italy, Somaliland could supply large quantities.

647 - **Sudanese Wool.** — See No. 624 of this *Review*.

648 — **Madagascar Leather.** — *Bulletin de l'Office colonial* (from *L'Europe nouvelle* of Nov. 16, 1918), Year XIII, No. 133, pp. 29-30. Paris-Méun, January, 1919.

France could obtain nearly all her requirements in leather from her colonies. Madagascar alone could furnish considerable amounts as is shown by the appended Table, which shows the exportation of leather from 1911 to 1915 inclusive:—

Years	Kg	Number of skins
1911	6 388 210	638 000
1912	7 346 616	735 000
1913	8 032 698	800 000
1914	5 525 932	552 000
1915	7 863 889	736 000

The average of the 5 years 1911-1915 represents an export of about 700 000 skins.

**AGRICULTURAL
PRODUCTS;
PRESERVING,
PACKING,
TRANSPORT,
TRADE**

649 — **On the Preservation of Oils.** — *Feuille d'informations du Ministère de l'Agriculture* Year XXIV, No. 11, p. 5. Paris, March 18, 1919.

Note communicated by the "Service de l'oléiculture".

In 1918 experiments were carried out on the treatment of the by-products obtained in the manufacture of oils, in order to find out the best way of treating the residuum of olives and of preserving olives to be used for making oil, and the oils themselves subjected to the influence of the atmosphere and light. The conclusions arrived at are given below:—

1) The best recipients for preserving oils are those that best isolate them from atmospheric agencies and sudden changes of temperature; the products keep perfectly in stoneware jars that are kept quite full.

2) When the products are being removed, when they are liable to be acted on by the air, there is always an appreciable increase of acidity; this increase in acidity is all the greater the more the volume of liquid and the surface in contact with the air are greater.

3) Metal recipients (tin-plate) are not advisable; they can be used, however, if placed in a store with a stable average temperature (12-15°C.).

4) Glass recipients are always preferable to metal ones, for they isolate the liquid better from changes of temperature.

5) In recipients made of ordinary glass, white ("frosted"), green, yellow and blue glass, placed in full light during all the experiments, the oils were not affected by the light in either closed or open rooms. The increase in acidity of the oils preserved in these recipients was always greater than that of oils kept in stoneware jars, about equal to that of oils kept in tins protected from the air and lower than the acidity of the drainage of tins.

Certain practical rules for the preservation of oils can be deduced from these conclusions. But the most curious observation was that, in bottles

coloured red or pink, the acidity of the oils had a marked tendency to decrease. This interesting observation will be verified experimentally by M. BONNET, Director of the "Service de l'oléiculture", at Marseilles.

650 - **The Preservation of Tomatoes in Tins.** — CARLES, P., in *L'Industrie française de la Conserve*, Year V, No. 25, pp. 391-393. Paris, December, 1918.

The makers of tomato preserves have a tendency to put their products up in tins, which enables them to hide the paleness and lack of density of the fruit gathered at the end of the season. The acidity of the pulp has little if any effect upon the metal when the fruit is of good quality, gathered when perfectly ripe. This holds good for the extracted, concentrated or reduced product. The French laws require that the product in this state should contain at least 15 gm. of dry matter per cent. But, in a case like this, the attack will take place if a little salt is added to the pulp to flavour it; here the vegetable acidity, by its mass, displaces the mineral acidity (hydrochloric acid), which attacks the metal, forming tin chloride, a substance not definitely toxic, but of doubtful harmlessness, since it does not occur naturally in any food. When the pulp is not of first class quality, or made with late-season fruit, the acidity is all the greater, at any rate more "bare", owing to the lack of sugar, pectic substances or other "metal isolators"; it then has more action on the metal. The action is considerably increased when sodium chloride is added; then, in time, the boxes bulge to such an extent that, on opening, the contents spurt out and much is lost.

It is not a question of putrid fermentation, but possibly, in certain cases, of alcoholic fermentation of the added natural sugar. The author ascribes it particularly to the action of the acidity on the tin. This could be proved by testing for the tin salt in the ash of the pulp. If there is a positive result, the tin is unsaleable, as it bulges and is contaminated with a salt foreign to the fruit. In consequence great care should be taken before canning reduced, concentrated or extracted natural tomato pulp in tins. The same applies to canning the pulp of sorrel, spinach or other acid vegetables.

651 - **Preservation of Beet Tops in Silos.** — CHAVASTELON, R., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. V, No. 7, pp. 221-223. Paris, February 19, 1919

Samples of sugar beet tops ensilaged in October-November in a silo of beaten earth covered with clay soil had been obtained in the following March from the sugar refinery at Bourdon (France); they were at once shut up, pressing them down tightly in glass jars provided with glass covers.

Part was analysed at once, the remainder being stored in a cellar after the covers were sealed on the jars with tallow, so that the changes could be followed.

When the jars were opened in May in the following year, i. e. after 14 months, the product had the same appearance and its odour was rather pleasant.

butter, and fish. The data published are the results of investigations and observations made by specialists of the U. S. Department of Agriculture.

The author (Professor in the Faculty of Science of Clermont-Ferrand) gives the results of his analyses of samples taken immediately and samples kept 14 months.

The practical lesson of the experiment is that, if the silage is well made, it can be kept in reserve if it is not utilised the first year, without any fear of losing any of its food value for a year or more: the perfection of the preservation depends on the care taken to keep the silage from the action of the air, as it should be kept under anaerobic conditions.

For these reasons the silo should be cemented, with smooth internal walls in the shape of rectangular parallelepipeds, open in front and above (e. g., 5 ft. wide and 6 ft. 6 in. high), the superior and anterior faces should be closed by slides fitting between the lateral walls, fixed in front when filling and covered above, after the silage has been beaten down well by a 9 in. layer of beaten earth; the more permeable the earth the thicker should be the layer used. The layer of earth should be rounded, being kept in shape by the application of fresh earth if required during the period of preservation. In hot weather the earth should be watered sufficiently to prevent it from cracking.

652 - **Chemistry of Sweet Clover Silage in Comparison with Alfalfa Silage.**—SWANSON C. O. and TAGG, E. L., in the *Journal of Agricultural Research*, Vol. XV, No. 2, pp 113-132 + 5 Figures. Washington, October 14, 1918.

After the alfalfa and sweet clover for the experiment had been cut they were left to wilt in the sun for 2 hours, then chopped up, and packed tightly into quart milk bottles which were then hermetically sealed. The alfalfa was bottled alone, the clover both alone and with 10 times its amount of ground maize. The material in each bottle was weighed (about 700 gm.). During the first week three bottles of each fodder (alfalfa, clover, clover and maize) were opened each day, during the second week every other day, each week during the next four weeks, and then each month for as long as was necessary. The silage was of the best quality, and when open it was weighed and the colour and quality judged. The moisture content of the fodder in each bottle was determined by 100 gm. samples. The aqueous extract was made with 100 gm. samples, using 43 cc. of carbon dioxide free water, shaking by machine for 2 hours, and filtration through a linen cloth. The filtrate was centrifugalised for 5 minutes, and completely freed from the super-natant dark liquid by passing through a folded filter. In this filtrate were determined: 1) The acidity by titration with phenolphthalein; 2) the acidity by the hydrogen electrode; 3) the amino-nitrogen by titration in the presence of formaldehyde with thymolphthalein as indicator; 4) the amino-nitrogen by titration in the presence of formaldehyde to a certain hydrogen-ion concentration determined by the hydrogen electrode; 5) the total nitrogen; 6) the total nitrogen in the water extract not precipitated by phosphotungstic acid.

The alcoholic extract was prepared with another 100 gm. sample of silage by the addition of 250 cc. of 95 % alcohol. After some time enough

carbon dioxide-free water was added to bring the volume up to 500 cc. The subsequent treatment was the same as that for the aqueous extract. The results, summarised in tables and figures, were as follows:—

The loss of weight of the silage after 98 days was about 1 %. Losses caused by fermentation in an hermetically sealed silo are, therefore, insignificant.

The acidity of the alcoholic extract of the three kinds of silage was higher than that of the water extract when titration was made to the point of colour change for phenolphthalein. With the electrometric method and titration to a hydrogen-ion concentration of $P_H = 8.3$ (point of colour change for phenolphthalein), the difference between the results obtained with the aqueous extract and the alcoholic extract was insignificant. The higher values obtained by the colorimetric method for the alcoholic extract were probably due to the strongly coloured matter extracted by the alcohol, thus hiding the end point.

Most of the acidity developed during the first 14 days.

The addition of maize meal to sweet clover increased the acidity of the silage.

The amino-nitrogen content was practically the same in the aqueous and alcoholic extracts. The amino-nitrogen content of alfalfa silage was much higher than that of clover silage without maize flour. The addition of maize flour to clover does not influence the amount of amino-nitrogen developed.

The amide-nitrogen content determined by STUTZER's method was a little higher than the amino-nitrogen content determined by the formaldehyde method. The amide nitrogen present was about one-half of the total nitrogen.

About $\frac{2}{3}$ of the total nitrogen of the silage was soluble in water and in 50 % alcohol, the action of the two solvents being about equal.

The results seem to show that it is more easy to make silage from sweet clover alone than from alfalfa alone.

653 - **Suitable Storage Conditions for Certain Perishable Food Products.** — *U. S. Department of Agriculture, Bulletin No. 729*, 10 pp. + 1 Table. Washington, July 24, 1918.

For some years the U. S. Department of Agriculture has been collecting information on the factors influencing the keeping of various perishable agricultural products in storage. Some of this information has already been published in various bulletins of the department, but much has not been made available for the use of those managing big storage warehouses. Recently the Federal Reserve Board asked the Department of Agriculture for information on the storing of the principal perishable commodities subject to a preferential rate of re-discount (best storage conditions, length of storage, percentage of shrinkage during storage, etc.).

The information given is summarised in a table, and deals with apples, potatoes, sweet potatoes, onions, cabbages, eggs, frozen eggs, poultry. The following data, extracted from the table, deal exclusively with the cold storage of perishable products.

Apples. — Apples to be cold stored should be suitably sorted and packed,

rapidly stored, cooled, and carefully inspected. The temperature should be from 31° to 32° F., and the relative humidity from 85 to 90 %. Duration of storage, from 3 to 6 months for winter varieties. Shrinkage in storage, from 2 to 5 %.

Potatoes. — Potatoes are sometimes cold stored. The temperature should be from 35° to 40°F., and the relative humidity 80 to 85 %. Duration of storage, 7 months or more.

Onions. — When onions are cold stored the temperature must be from 32° to 36°F., and the humidity low. They should be examined each month.

Eggs. — The temperature should be from 20° to 32°F., and the humidity from 82 to 85 %. *Fresh* clean eggs with unbroken shells can be stored for 9 to 10 months. The sale of preserved eggs begins at the end of summer and continues till March. The maximum shrinkage is 5.5 %.

For *frozen* eggs the cold storage temperature must be from 0° to 10°F. They should be transported in refrigerating waggons.

Dressed poultry. — Poultry to be cold stored must be fresh. The best temperature is from 0° to 10°F. The duration of storage is 12 months, and the shrinkage 1 to 3 %.

Butter. — The temperature must not exceed 20°F. Butter to be held in cold storage for several months must be made from cream of limited acidity, pasteurised, cooked, and churned without further ripening. The shrinkage is in general from 0.5 to 1 %. Storage should not last more than 12 months.

Fish. — Fish may be stored for not more than one year at a temperature of 0° to 10°F, and must be inspected each month. The shrinkage is of no commercial importance.

654 — **The Frozen Meat Industry in South America.** — MIDDLEBROW, in *El Campo*, year III, No 25, pp. 5-7. Buenos Ayres, November 1918.

According to semi-official estimates there were 27 050 000 cattle and 44 850 000 sheep in the Argentine in 1918, but the author thinks these figures are far short of the truth. The great development of stock rearing in the Argentine is due to the cultivation of lucerne. In 1895, this fodder plant was grown on 713 000 hectares only; in 1919, 4 706 000 hectares; in 1918, 9 million hectares, which is probably a world record. While in 1913 the value of all the products of stock rearing, or 200 million gold pesos, represented less than 40 % of the total exports, in 1917 it had reached 376 million gold pesos, or 68 % of the total exports.

The exportation of meat from the Argentine was almost constant from 1911 to 1915; in 1916, it increased by 32% over the figures of the previous year; in 1917, it reached 559 216 metric tons.

In 1914, 13 000 metric tons of cold storage meat were exported from the Argentine, while over 100 000 metric tons in 1917 and about 150 000 metric tons in 1918 were exported. In Europe the consumption, from 46 000 metric tons in 1913, became 415 000 metric tons in 1917, in which year the world's production was 965,000 metric tons, divided as follows: — South America, 540 000 m. tons; Australia, 119 000 m. tons; New Zealand, 117 000

m. tons ; Canada, 55 000 m. tons ; South Africa, 22 000 m. tons ; United States and other countries, 112 000 m. tons.

The first Argentine frozen meat works was founded at Campana, on the rio Paraná, by the River Plate Fresh Meat Co. At present (1918) the following firms have frozen meat works for cattle : — La Negra, Wilson, La Blanca at Avellaneda ; Armour, Swift, at la Plata ; Las Palmas, at Campana and Las Palmas ; Anglo, Smithfields, at Zarate ; Cuatros, at Bahia Blanca. Of works dealing with sheep there are those of the Swift Co. at San Julian and Rio Gallegos and those (on the coasts of Patagonia, Argentina and Chili), of San Gregorio, Rio Seco, Ultima Esperanza and Rio Grande. The Armour Co. has just finished one at Santa Cruz. At Montevideo there are three important works belonging to the firms of Swift, Uruguaya and Artigas. The frozen meat establishments in Argentina slaughter 15 000 cattle and 25 000 sheep a day and employ over 30 000 workmen.

One of the greatest efforts accomplished by the frozen meat industry in Argentina under the abnormal conditions of the war was to have frozen all the meat (e. e., brought it to a temperature below 0° C., which requires 5 to 6 days) instead of chilling it (i. e., brought to a temperature slightly above 0° C., which requires 46 hours) as was usual before the war. In 1918 practically no chilled meat was exported from the Argentine, while, before the war, some 3 million quarters were exported yearly. Frozen meat works are often able to increase their production without any corresponding increase in space or machinery.

The North-American companies have founded large works in Brazil, Uruguay and Paraguay ; in Uruguay, 141 000 head were slaughtered in 1913, against 528 000 in 1917 (perhaps half the production). In the first 7 months of 1915, Brazil only exported 6 metric tons of preserved meat ; during the same period of 1918, about 10 000 metric tons were exported, while the quantity of frozen meat shipped, which had been *nil* in the first seven months of 1914, was over 40 000 metric tons for the same period in 1918. In Paraguay there are 3 large works that preserve meat ; in 1916 there was not one.

There is a very promising market in the United States for the sale of Argentine frozen meat, in spite of efforts made by the former country to increase its livestock population. In fact before the war, its livestock was decreasing but, owing to the great efforts made to increase stock rearing, the number had reached 66 830 000 head on January 1, 1918, an increase of about 5 % over the number for 1917 and over 18 % more than that for 1913, when the minimum number of 56 527 000 head had been recorded. While the United States had exported a negligible quantity of meat to Europe in 1913, in 1917, over 100 000 tons were exported. But this increase was obtained by curtailing home consumption, for the United States cannot be considered, under normal conditions, as an exporter of frozen meat, but rather as an importer. In fact, in 1914, the United States imported 53 000 metric tons from the Argentine and 17 700 m. tons from Australia.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

655 - "Matizado" a Disease of Sugar Cane Observed in the Island of Porto Rico. — STEVENSON, J. A., in the *Revista de Agricultura de Puerto Rico*, Vol. I, Nos. 1-2, pp. 18-25 + 1 Fig. San Juan, Porto Rico, April-May, 1918.

The disease of sugar cane called "matizado" has been long known in Porto-Rico, but it has only been studied specially for the last two years or so.

The first researches showed that it is a serious infection that extends from the zone including the region of Arecibo and Utuado up to the plantations of Aguadilla. Since then the disease has spread rapidly, as it now occurs from Rio Piedras to Aguadilla on the northern coast of the island, and from Ponce to Cabo Rojo on the southern coast.

The plantations on the extreme west of the island like those in the neighbourhood of Utuado, Ajuntas and other localities in the centre, are very severely attacked by the disease. The greatest damage was observed in the plantations of Camuy, Quebradillas and Isabela.

Considerable losses have been recorded. The diseased plants stop growing; the first shoot does not grow to the right shape and the second and third cannot be utilised. The trade will not buy diseased canes.

The disease can be easily recognised when it appears on the leaves in its typical form. A kind of mosaic produced by yellowish white irregular blotches with fimbriate edges appears on the plant organs. The bottom of the attacked part usually remains greenish and may become yellow as the disease progresses. The blotches may be scanty and spread over the surface, or they may be so numerous as to cover a large part of the blade. At the onset of the attack, whether on the stem or on the very young leaves, the bottom of the invaded area is of a yellowish or yellowish green colour, interrupted with spots of an apparently normal green colour. Besides the fact that the leaves are blotched, diseased plants tend to become withered or dwarfed. In the case of an advanced attack, scabby, slightly hollow, longitudinal blotches, of a dark colour that finally turns grey, appear on the stem. These blotches may become so numerous as completely to cover the stem, which then shrinks and dries up.

At first the white or "Otahiti" cane was found to be specially liable to the disease and it can now no longer be grown. The striated cane, at first sufficiently resistant, is now seriously attacked in many places. The wine-coloured cane known as "Cavengerie" is apparently losing its immu-

nity. Many varieties, especially foreign ones, have been tried in infected soil, and although not one of them has proved to be free from the disease, their different degree of susceptibility appears to allow some hope for the future.

"Matizado" is now considered as an infectious disease caused by a disturbance or change in the sap. It has been proved that the disease is transmitted by cuttings from infected canes; but there are also other means of transmission.

In order to combat the disease:— 1) use cuttings from healthy plants only; 2) remove and destroy infected canes or, at any rate, cut them if it is not possible to remove them completely; 3) when the infected canes are too numerous in a plantation and when their destruction would not benefit the plantation economically, it is best to plough them up and grow another kind of crop; 4) introduce and test resistant varieties of cane; 5) improve existing methods of cultivation.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

- 656 - **Myxomycetes, Bacteria and Fungi of Porto Rico.** — STEVENSON, J. A., in *The Journal of the Department of Agriculture, of Porto Rico*, Vol. II, No. 3, pp. 125-264, San Juan, P. R., July, 1918.

GENERAL

Reports on the myxomycetes, bacteria, and fungi of Porto Rico are scattered in numerous publications, most of which are edited outside the island and are, therefore, not easily or quickly accessible by those studying these micro-organisms on the spot. For this reason it was opportune to unite in one paper, like that under review, a list of all the myxomycetes, bacteria, and fungi reported for Porto Rico, their host, the locality in which they were found, the names of those who found them, and a bibliography on the subject.

The species enumerated do not form a complete list of the island flora in myxomycetes, bacteria, and fungi properly speaking. The list given must rather be considered as the starting point for a more thorough study by local collectors who may add to it the species found by them. The number of species given might easily be doubled. The author has not had the necessary time or means to undertake a critical study of the species enumerated.

The list includes 1035 species divided into 312 genera. To make the reader's task easier this list is followed by two supplementary indices, one of the host plants, the other of the families and genera mentioned in the work. The bibliography includes 103 English publications, 1 German, and 1 Spanish.

- 657 - **Resistance of Various Wheats to Rust and Lodging, in Tuscany, Italy.** — See No. 581 of this *Review*.

RESISTANT
PLANTS.
MEANS OF
PREVENTION
AND CONTROL

- 658 - **Patents for the Prevention and Control of Diseases and Pests of Plant.** — See No. 639 of this *Review*.

- 659 - **A Third Biologic Form of *Puccinia graminis* on Wheat.** — LEVINE, M.N. and STAKMAN, E. C., in the *Journal of Agricultural Research*, Vol. XIII, No. 12, pp. 651-654. Washington, D. C., June 17, 1918.

Up to the present two biologic forms of *Puccinia graminis* Pers. have been reported — *P. graminis* f. *Tritici* Erikss. and Henn. and *P. graminis* f. *Tritici-compacti* Stack. and Piem.

On October 18, 1917, *P. graminis* was found on a clump of wild wheat at Stillwater, Oklahoma. Repeated cultural experiments made by the Agricultural Station of Minnesota University and the U. S. Department of Agriculture, Bureau of Plant Industry, showed the rust to be a form distinct from the two biologic ones mentioned. Experiments on this third unidentified biologic form are in progress.

- 660 - **Yellow-Leafblotch of Alfalfa Caused by the Fungus *Pyrenopeziza medicaginis*.** — JONLS, F. R., in the *Journal of Agricultural Research*, Vol. XIII, No. 6 pp. 307-329 + 6 Figs. + 3 Plates Washington, May 6, 1918.

Under the name of Yellow-leafblotch of alfalfa the author describes a serious fungoid disease of wheat, observed in America between 1915 and 1917 only. It has been known for a long time in Europe, where it is not regarded as serious. In the United States it has so far been observed in Vermont, New Jersey, Virginia, New York, Ohio, Kentucky, Tennessee, Wisconsin, Minnesota, Iowa, Kansas, South Dakota, California, Idaho, Oregon, and Washington. There seems no doubt that it occurs in all the large alfalfa-growing districts of the United States.

The disease may usually be distinguished by the appearance of a long yellow blotch on the leaf. Later small orange-coloured points (pycnidia) appear on the upper surface of the leaf. These points soon turn deep brown, and even almost black. The affected part of the leaf dies and, on the under surface, rarely on the upper one, appear small black dots (apothecia), different from the first ones. The disease also attacks the stems, but less badly than the leaves.

The disease injures the plant directly by slowly killing the affected leaves, or indirectly by favouring the access and development of other organisms in the weakened leaves.

The causal organism, *Pyrenopeziza medicaginis* Fuckel, is a discomycete which, as has already been said, produces first a conidial stage (*Sporonema phacidioides* Desmazières) on the living leaves, and later, ascigerous stages (*Pyr. Medicagensis*) on the part already killed by the fungus. The fungus has been grown in cultures and both stages of the parasite produced.

Infection seems to occur only through ascospores which, upon germinating, penetrate the epidermal cells of the leaf. The fungus hibernates on dead leaves, infected the previous autumn.

Cutting diseased alfalfa before the ascigerous stage has developed on infected leaves appears to hold the disease in check.

- 661 - **Diseases and Pests of Hevea in Belgian Congo.** — See No. 600 of this *Review*,

662 - **Cryptogamic Diseases of the Beet Favoured by an Excess of Sodium Nitrate, in France.** — See No. 574 of this *Review*.

663 - **A Leafblight of *Kalmia latifolia*, in Columbia, U. S. A.** — ENLWS, E. M. A., in the *Journal of Agricultural Research*, Vol. XIII, No. 1, pp. 199-212 + 2 Figs. + 4 Plates. Washington, April 15, 1918).

During the summer of 1914 a bed of *Kalmia latifolia* L. (mountain laurel) in the grounds of the U. S. Department of Agriculture was attacked by a disease characterised by the appearance of small, irregular, dark brown spots on large areas on the blade or the whole leaf. In its early stages the disease frequently occurs at or near the tip of the leaf, or near its edge. Gradually the disease passes down the petioles to the branches, and may eventually kill the whole plant. The author also found the disease in Rock Creek Park and on the hills round Anacostia, D. C.

Sections of infected leaves showed the presence of a very delicate mycelium in the tissues. Cultures were made and a fungus isolated which was found experimentally to be the cause of the disease. The author considers this fungus to be a species new to science, and describes it under the name of *Phomopsis Kalmiae*.

664 - **Diseases and Pests of *Pinus Pinea* in Italy.** — See No. 609 of this *Review*.

665 - ***Keithia thujina* a Discomycetes Injurious to *Thuya gigantea* in Ireland.** — LETH BRID E, G. H., in the *Quarterly Journal of Forestry*, Vol. XIII, No. 2, pp. 93-97. London, April, 1919.

In July 1918, the author visited a tree nursery in Banureagh, Queen's County, where a serious loss of young larch trees and *Thuya gigantea* Nutt. had been reported.

No fungus was visible on the young larches, the leaves of which turned yellow and fell prematurely. Subsequent investigations in the laboratory, however, showed the twigs and leaves of the plant to be completely covered by the mycelium of a *Botrytis* which had probably the cause of their fading.

The case of the *Thuya* plants which were three years old was quite different. They were nearly all dead; only here and there in the rows was found a specimen which, near the base, still had green leaves and small parts of the twigs. On the leaves of the dead parts was an abundance of a kind of small, round, flat, brown-black, more or less gelatinous, blister. A microscopical examination showed these to be apothecia of an ascomycete subsequently determined by E. M. WAKEFIELD as *Keithia thujina* Durand, a discomycete discovered in 1908 on leaves of *Thuya occidentalis* Muller, in Wisconsin, U. S. A. So far as is known this is the first time the fungus has been found in Great Britain, and it has not yet been noticed in other parts of Europe.

It is almost certain that hundreds of young *Thuya gigantea* plants in the Banureagh nursery have been killed by this ascomycete. While on a visit to the district the author was unable to make a systematic search for the fungus on old specimens of the tree in different plantations, but it

was nevertheless found on a tree in a plantation about ten years old. In this case the damage to the host was not very serious, but this does not mean that the parasite will not become very injurious in the future.

It is not known how the fungus came to Baunreagh. Except for the case described its presence outside North America has not been reported. It is possible that such a fungus may have been introduced on imported seed, especially if it be found to attack the scales of the cones.

Its spores might be carried mechanically on seed, or they, and perhaps the apothecia also, may be carried on whole cones or bits of cones mixed with commercial seed. If this be so it would be of value if those handling *Thuja* seeds sent some to be examined. If attacks as violent as that at Baunreagh were to occur in other nurseries, all the young dead or dying plants should be immediately pulled up and burnt.

When choosing a position in which to plant a nursery, consideration must be given not only to the nature of the soil, its exposure, etc., but also to the health of the trees in the immediate neighbourhood, so as to eliminate as far as possible all probability of the young trees in the nursery being infected by diseased trees near by.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

4

RESISTANT PLANTS

666 - **Vines Resistant to Phylloxera in Apulia, Italy.** — See No. 560 of this Review.

667 - **"Filao" (*Casuarina*) spp., Trees with Wood Resistant to Insects, Especially Ants, in Senegal.** — See No. 612 of this Review.

MEANS PREVENTION AND CONTROL

668 - **On a Parasitic *Drosophila* from Trinidad.** — LAMB, C. G., in the *Bulletin of Entomological Research*, Vol. IX, Pt. 2, pp. 157-162 + 4 Figs. London, September, 1918.

A description is given of a new species, *Drosophila paradoxa*, established from two males and one female found at St. Joseph, Trinidad, in December 1917 by Mr. C. B. WILLIAMS, who said it was parasitic on a Cercopid (*Clastoptera* sp.) which was found attacking cacao trees.

The author examined a female of the genus *Drosophila*, also found by Mr. WILLIAMS at Changunda, Panama, in November, 1917. This specimen seemed, from a superficial examination, to resemble *D. paradoxa* in many ways, but to differ from it in certain characters.

Later observations by Mr. WILLIAMS showed the Panama *Drosophila* is probably not a true parasite of *Clastoptera* sp., but simply an inquiline. In Trinidad he collected about thirty spittle-masses of the same *Clastoptera* about half of which contained *Drosophila* larvae, most of which had their heads buried in the abdomen of the *Clastoptera* pupae.

669 - ***Sycophrurus hesperophanis* n. gen. and n. sp., a Hymenopterous Parasite of the Beetle *Hesperophanes griseus* Injurious to the Fig Tree in France.** — PICARD, F. in the *Bulletin de la Société entomologique de France*, No. 3, pp. 77-80. Paris, 1919.

Hesperophanes griseus, which is the commonest Cerambycid beetle in fig wood, is parasitised in the larval state by an ichneumon, fairly common

at Montpellier, which the author describes as belonging to a new genus and species under the name of *Sycophyrurus hesperophanis*. The hymenopteron hatches out at Montpellier in June, more rarely in May, from fig branches attacked by *H. griseus*.

The author mentions *Iphiaulax flavator* F. and *Xylonomus propinquus* Tsch. as two other parasites of the cerambycid beetle in question.

670 - *Euclemensia bassettella* a Microlepidopteron Parasitic on *Kermes* spp., Coccidae Infesting *Quercus* spp. in Missouri and Texas, U. S. A. — HOLLINGER, A. H. and PARKS, H. B. in *Entomological News*, Vol. XXX, No. 4, pp. 91-100 + 1 Plate, Philadelphia, April, 1919.

Euclemensia bassettella (Clemens) has been reported in Connecticut, Florida, Kansas, Massachusetts, and Texas. The authors, who found it in large numbers in Missouri and Texas, believe it to be common in the western half of the United States at least, and that the species exists in nearly all the States to the east of the Rocky Mountains and probably throughout the North American Confederation.

It was originally thought that the larva of the insect feeds on the galls which develop on oak trees. It was later found that, like several other microlepidoptera, *E. bassettella* in the larval state, is parasitic on the scale insect (*Kermes* spp.) which live on oaks and are mistaken for galls. The authors' investigations confirm this theory.

In April, 1917, near Albany, Gentry County, Missouri, PARKS found a specimen of *Quercus imbricaria* Michx., badly infested with *Kermes pectitii* Ehrh. Subsequent careful investigations showed that some of the coccidae contained larvae of a lepidopteron identified by BUSCK, after it had been bred in the laboratory by HOLLINGER, as *E. bassettella*. The breeding was begun on June 9, and the first adult insect emerged on the 27th of the same month. By the middle of July, 23 adults had already emerged. On July 12, some of the apparently normal *Kermes* were opened, and in them were found three larvae and four pupae of the lepidopteron. The adults of these were observed at liberty during July, 1917, and were found by Dr. HASEMAN visiting onion flowers. An adult was taken by HOLLINGER in his own kitchen garden on August 15.

In January, 1918, the authors found *Q. stellata* Wangenh., near Corsicana, Navarro County, Texas, badly infested with *K. galliformis* Riley. The coccidae were seriously attacked by larvae of *E. bassettella*. Adult microlepidoptera emerged in the laboratory from collected material towards the middle of July. *E. bassettella* has been observed as a parasite of the coccid in other localities in Texas, on *Q. stellata*, *Q. marylandica* Moench, *G. virginiana* Mill., *Q. undulata* Torr., and *Q. nigra* L. On August 3, 1918, a single adult *E. bassettella* was found by PARKS in a field of cultivated onions in Robertson County.

The insect seems to have a single generation a year. So far no parasite is known to attack *E. bassettella* in any of its stages. The insect has been found sufficiently plentiful to reduce appreciably the number of the coccid on which it preys.

Morphological descriptions are given of the larvae, pupa, and adult of *E. bassettella*, together with information on the habits of the insect.

INSECTS, ETC.,
INJURIOUS
TO VARIOUS
CROPS

671 - **A Froghopper on Sugar-Cane in British Guiana** (1). — WILLIAMS; C. B., in the *Bulletin of Entomological Research*, Vol. IX, Pt. 2, pp. 163-173 + 3 Figs. London, September, 1918.

All along the coast of British Guiana and, as shown by observations made by the author in 1916, more especially along the East Coast, west of the Essequibo River sugar cane is attacked by the froghopper (*Tomaspis flavilatera* Unch). So far the insect has done no really serious injury to this crop, but growers look upon it with suspicion after the experience with *T. saccharina* Dist., which has become the greatest pest of sugar cane in Trinidad.

The author gives much information on the eggs, pupae, and adults of *T. flavilatera* which, in addition to sugar cane, seems to feed on nearly all the grasses in the infested zone. Pupae of the insect were found on *Cynodon Dactylon*, *Cynodon* sp., *Stipa* sp., and *Panicum laxum*. Adults were found in rice plantations sucking the stems of rice, though they do not appear to do it great injury.

During August and September, 1916, the following natural enemies of *T. flavilatera* were observed; all were fairly common:

1) EGG PARASITES: — The Vermilion Parasite (*Oligosita giraulti*) and *Haplothrips* sp.

2) PARASITE OF THE PUPA: — The Syrphid Fly (*Salpingogaster nigra*) already reported from British Guiana, in 1914.

3) PARASITES OF THE ADULT: — Very abundant dragonflies, atid spiders, two species of predatory ants, the heteroptera *Heza peramala* Kirby and *Zelus mimus* Stål, the grasshoppers *Pfluegis mantispa* Bol., and *Xiphidium propinquum* Redt., lizards, birds (*Tyrannus melancholicus*, *Muscivora tyrannus*, *Fluvicola pica*, *Arundinicola leucocephala*, *Crotophaga ani*, *Icterus xanthorhous*, *Quiscalus lugubris*, *Volatina jacarina*), and the mongoose.

Before the author's visit the artificial means of control used against *T. flavilatera* consisted in flooding the land and collecting the pupae by hand. The author adopted the use of sweep-nets to catch the adults which are often found sitting on the short grass in the drains. After testing several kinds of net, a special kind was evolved by means of which a boy can catch an average of 1000 insects an hour. The boys were offered two cents per hundred adults taken. During September, 1916, on one plantation two to ten boys caught 533 540 adults in 22 days. During the same period 540 000 pupae were collected by hand, but this required a larger gang and a higher price (four to five cents per hundred pupae).

Contrary to what is found in Trinidad, the sweep-net has proved far more efficacious than light traps in British Guiana.

Reasons are given why *T. flavilatera* has so far caused very little damage in British Guiana in comparison with that done by *T. saccharina* in Trinidad. Firstly the climatic and cultural conditions in British Guiana are

(1) See R. June 1914, No. 589 and April, 1917, No. 395. (Ed.)

favourable to the continual, regular existence, not only of the froghopper, but also of its natural enemies throughout the year. Moreover, planters are aware of the danger of attacks of the large moth borer (*Casnia licus*) on sugar cane and always have an organized insect gang at work. As the damage done by froghoppers in Trinidad is well known, the slightest trace of them in a plantation is immediately reported and very energetic measures taken to exterminate them. One of the most efficacious methods adopted against these insects in British Guiana is flooding, which is quite impossible in Trinidad. The mongoose, considered as indirectly responsible for the abundance of froghoppers in Trinidad because it destroys its natural enemies (birds and reptiles), is comparatively rare in British Guiana. Although on some plantations, a large proportion of the canes are burnt before cutting, yet, on account of the scarcity of labour, cutting is not limited to one season, as in Trinidad, and some canes are always standing and serve as shelter. Moreover, when burning is practised it is done at night, when the soil is moist with dew, or on damp days, so that some of the trash on the ground and grass in the drains always remain, and the eggs and their parasites survive. In comparison with Trinidad there is, in British Guiana, very little waste land to serve as a source of infestation.

The list of natural enemies of the froghopper in British Guiana is practically the same as that for Trinidad, and with the exception of the green muscardine fungus (*Metarrhizium Anisopliae*) which might be introduced. Any new parasite found in Trinidad should also be useful in British Guiana.

672 - *Lymidus variicolor* n. sp., A Coleopteron Injurious to Cacao Trees, in the Island of São Thome. — BERLIOZ, J., in the *Bulletin de la Société entomologique de France*, No. 4, pp. 88-89. Paris, 1919.

A description is given of a new species, *Lymidus variicolor* (fam. *Chrysomelidae*) found by A. F. DE SEABRA, in the island of São Thome, where this insect seems to live on leaves of *Theobroma Cacao*

673 - *Insects Injurious to the Olive Trees, in Apulia, Italy.* — See No. 598 of this Review.

674 - *The Passion Vine Longicorn Beetle, in New South Wales, Australia.* — PROGGATT, W. W., in *The Agricultural Gazette of New South Wales*, Vol. XXX, Pt. 1, pp. 37-38 + 1 Plate. Sydney, January 2, 1919.

The passion vine longicorn beetle (*Monohammus fistulator* Germar) has recently been reported as injurious to the passion vine (*Passiflora*) in the Somersby district, near Gosford, New South Wales. It is probable that the insects have been present in fewer numbers in the orchards of the district for two or three years. The larvae bore galleries in the stems of the host-plant and pupate there.

A description is given of the larva, pupa, and adult.

A mixture of lime and sulphur applied from October to January may prevent the beetles from laying their eggs in the bark. As the eggs are deposited in the bark on the main stems during this period, it is possible to detect their presence by the cut made by the insect to deposit the eggs, and to destroy them.

Local infestation often originates from a dead or dying tree, either fallen or cut and left standing, in which the beetles deposit their eggs. When the fully developed insect emerges it lays its eggs in the first suitable wild or cultivated plant. For this reason dead timber is often a serious danger to an orchard or garden.

675 - *Cimbex quadrimaculata*, A Hymenopteron Injurious to Almond Trees, in Italy. — SARRA, R., in the *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XII, pp. 275-286 + 4 Fig. Portici, 1917-1918.

A description is given of *Cimbex quadrimaculata* Müll., together with biological notes on this insect, observed principally on almond trees of recent years at Santeramo Colle, province of Bari, and Matera, province of Potenza. Only two larvae of this insect (fam. *Tenthredinidae*) were found by the author on hawthorn on which the insect lives in other parts of Italy. The larva of *C. quadrimaculata* had already been reported as injurious to vines at Bari, but the author never found it on that plant. Nor does it attack the vine in Sicily. In Belgium, where it is rare, it lives on hawthorn and plum trees. It is not included among the larvae considered injurious to the almond trees by those concerned with the cultivation of this tree in Italy and elsewhere (1).

The adult insects emerge during the last days of March and first ten days of April. The eggs are deposited in the leaves of almond trees towards the middle of April. During the first ten days of May the larvae hatch. Each one of these may destroy partly or totally, according to its age, from one to three leaves a day. In one day, therefore, twenty full-grown larvae may destroy 60 leaves, and in ten days, 600. The most serious damage is done to seedlings in the nursery and young, grafted trees. The larva undergoes three moults. From mid-June till the first ten days of July it weaves its cocoon under stones or in the ground. There it remains till the end of February or middle of March of the following year, when it pupates. The pupal stage lasts about a month. The insect has one generation a year.

The author found that two other hymenoptera (fam. *Ichneumonidae*) oppose the damage done by *Cimbex*. These are *Opheltetes glaucopterus*, L. and *Lampronota melancholica* Grav., both with only one generation a year. The larvae of *C. quadrimaculata* are parasitised by *O. glaucopterus* and *L. melancholica* in the proportion of 20 and 25 % respectively.

On young grafted almond trees and nursery plants *Cimbex* larvae are controlled by collection and destruction, or, better still, by spraying the leaves with poisonous substances in May. This method is very costly and unpractical on trees with high, thick trunks, and on such trees, it is best to leave the larvae to the attacks of the above-mentioned ichneumonids.

(1) REH, L., *Die tierischen Feinde*, in SORAUER, P., *Handbuch der Pflanzenkrankheiten*, Berlin, 1913, Vol. III, p. 600, reports that, in 1905, the insect in question did great damage to almond trees in Bulgaria. (Ed.)

- 676 - *Corythucha parshleyi*, a Rhynchote Injurious to *Juglans* spp., in New Jersey, U. S. A. — WEISS, H. B. and DICKERSON, E. L., in *The Canadian Entomologist*, Vol. L, No. 12, pp. 401-406. London, December, 1918,

This species was described in 1918 by E. K. GIBSON from specimens collected by the authors on *Juglans nigra* at Hammonton, in the south of New Jersey. By mistake GIBSON also mentioned *Amelanchier intermedia* as a host plant of *Corythucha parshleyi*. The authors found the insect in the same locality on *J. cinerea* and *J. Sieboldiana*; at Cedarville and Bridgeton they again found it on *J. nigra*. Dr. LÜTZ found it at Ramsey, New Jersey, and it has been reported from Lake Waccamaw, North Carolina, on *Carya olivaeformis*, and from Great Falls, Virginia, on *J. nigra*. There is no doubt that the insect also exists in many other localities, and has probably been erroneously entered in collections as *C. juglandis* Fitch.

The larvae live in colonies on the under surface of the host plant, causing discolouration of the upper surface. In cases of bad infestation the leaves turn yellow, dry up and fall in large numbers.

The authors describe some of the biological observations of the insect made by them at Hammonton, and give a description of the egg, the five larval stages, and the adult.

- 677 - The Seedling-Gum Moth (*Nola metallopa*), Injurious to the Crimson-Flower Gum and the Red Gum, in New South Wales, Australia. — FROGGATT, W. W., in the *Agricultural Gazette of New South Wales*, Vol. XXX, Pt. 3, pp. 203-206 + 1 Plate. Sydney, March 3, 1919.

At the beginning of 1899, in a nursery at Botany, near Sydney, the author found numerous seedlings of crimson-flower gum (*Eucalyptus ficifolia*) with leaves badly infested with larvae of the seedling-gum moth (*Nola metallopa* Walker). In the notes published in 1900 on his observations on this subject, the author showed this moth to be comparatively rare in collections, although described for Australia many years before.

After 1900 only a few larvae were found now and again damaging young gum trees. During November, 1918, however, the moth was reported as doing great damage to red gum over a large area in the Deniliquin district. In this district the trees were stripped of most of their leaves, the twigs and small branches were mostly dead, and in many cases even the outer thin layer of green bark was attacked by the insect.

The larva, pupa, and adult of the moth are described.

- 678 - *Chalepus rubra*, a Coleopteron Injurious to Oaks, in New Jersey, U. A. — NICOLAY, A. S. and WEISS, H. B., in *The Canadian Entomologist*, Vol. L, No. 12, pp. 398-400 + 1 Plate. London, December, 1918.

Chalepus rubra Web., a coleopteron widely distributed throughout New Jersey State, is common there during May, June and September on *Robinia* and sometimes on *Tilia*. It has been frequently found by the authors damaging leaves of different species of oak.

The larva of the insect bores a gallery, usually near the edge of the leaf by eating the parenchyma of the part attacked. The gallery is visible on

both surfaces of the blade, but more distinct on the upper surface, where it appears as a long, irregular, white patch. During the second half of June the larvae may easily be found in their galleries. The authors never found more than one larva in each gallery. The pupal stage lasts about two weeks (last week of July and beginning of August. The adults emerge during the second week of August, or even later.

A full description of the larva and pupa is given.

679 - *Phylloxera stanfordiana* n. sp., a Rhynchote Observed on *Quercus Douglasii*, in California. — FERRIS, G. in *Entomological News*, Vol. XXX, No. 4, pp. 103-105 + 4 Figs. Philadelphia, April, 1919.

The genus *Phylloxera* seems to be very little represented in the west of the United States. In addition to *Phyll. vastatrix* Planch. of the vine the only species in California appear to be the two reported by DAVIDSON — *Phyll. popularia* Perg., on poplars, and *Phyll. salicola* Perg., on willows.

The author describes another species of *Phylloxera*, apparently new to science, found on oak. It is probably the first *Phylloxera* found on this plant to the west of the Missouri. It is *Phyll. stanfordiana* n. sp., and was found by the author on *Quercus Douglasii* in the grounds of Stanford University, California, on September 10, 1918.

A description is also given of the female of a species of *Phylloxera* found chiefly on twigs of *Populus trichocarpa* and *Salix* sp. at San Francisco Creek, near Stanford University, and of *P. candicans* at Salt Lake City, Utah. The author identified it as *Phyll. salicola* Perg. ? It is a little doubtful whether the species in question is really *Phyll. salicola* Perg., although it is similar to this species in many of its characters. There is no doubt that it does not correspond to *Phyll. popularia* Perg.

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INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

680 - **Products from Hainan Island (China) and the Agricultural Future of that Country.** — *Bulletin économique de l'Indochine*, Year XXI, New series, No 133, p. 1129. Hanoi-Haiphong, November-December, 1918

DEVELOPPEMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

The British Consul in charge at Kiungchow and Packnoi states that there are at the present moment at Hainan (an island in the Gulf of Tonkin, province of Kouang-Joung, China) about 25 companies cultivating Indiarubber. The products obtained are of the best quality, and were quoted at the end of September, in the market at Singapore, at 110 dollars the *picul*. Although the Singapore dollar is at present worth only 65 % of the Shanghai dollar, the price reached was none the less most interesting (1).

At Nodoo a single company employs 500 workmen and has expended 150 000 dollars in constructing a cart road for the use of the plantation, which contains about 10 000 rubber plants.

A technical expert sent to Hainan by an association of Chinese merchants of Malacca stated that they intended to cultivate rubber in the island.

Coffee too thrives very well at Hainan and the plantations are prospering, but exports are not yet organised on a large scale.

Products of Hainan Island shown at the last agricultural exhibition at Canton were numerous. For example: — pine-apple fibre, cotton, tobacco, rice, castor-oil, various oils; Packoi particularly sent pepper and aniseed; Linchow was represented by its rice and beans; Chinchow by yellow silk.

From this account the possible prosperity of Hainan, and the utility of its regular and scientific cultivation can be judged.

(1) The Shanghai dollar is the «Mexican dollar» much used in this town (5 1825 francs at par) (Ed)

681 - **Overwintering of the House Fly.** — HUTCHISON, R. H., in the *Journal of Agricultural Research*, Vol. XIII, No. 3, pp. 149-169 + 1 Plate + Bibliography of 18 Publications. Washington, April, 15, 1918.

The study of the wintering of the housefly was begun during the autumn of 1914 at the Arlington Experimental Farm of the Bureau of Plant Industry. In 1915 it was transferred to the Experiment Station of the Bureau of Animal Industry at Bethesda, Md. The conclusions drawn from the investigations were as follows :

In the latitude of Washington flies may hibernate in two ways:—
1) by uninterrupted reproduction in warm places where food is available and where they may lay; 2) during the pupal or larval stages in or under large manure heaps. There is no proof that flies continue to live in the adult stage, from November to April in the open air, in stables having a roof, but no walls, in attics, or in heated buildings, or even that they are capable of doing so. Temperatures of from -9 to -10°C are rapidly fatal to flies, and everything goes to show that a temperature below zero is fatal to them if sufficiently prolonged. In heated buildings they live no longer than in equal temperatures in summer; neither their development nor their sexual activity is suspended or retarded.

Flies continue to emerge from manure heaps up to the first week in December. Many of these late hatched flies enter heated buildings on warm days; those which do not soon die. Those which enter heated buildings are, as in summer, attracted by the smell of food, and collect in kitchens, dining rooms, stables, etc. If they do not find food to eat they rapidly die. Should they find food they may continue to live throughout December, January, and even February, unless they perish through the attacks of fungi. As yet no experiment or observation has shown that they may live throughout the winter till the return of a temperature sufficiently high to allow them to live in the open air and to lay. If in the autumn flies enter heated buildings where they can find food and suitable places for laying their eggs, as in stables or restaurants in which refuse is left about, they continue reproduction all through the winter. In such case the flies found in March and April are the descendants, not the survivors, of those which found shelter in these places the previous autumn. This method of wintering is probably much more common than is thought, especially in towns where there must be numerous centres of propagation which the flies leave on the warm days of March and April, and these flies produce the swarms which begin to appear at the end of May.

The possibility of flies hibernating in the pupal or larval state has been shown at Washington and Columbo, Ohio, as well as in the more temperate districts of Texas. It is not yet possible, however, to say whether this method or that of continual reproduction is the more common. Judging by the author's experiments with larvae and pupae, and by the fact that flies do not appear in large numbers till the end of May or the beginning of

(1) See also R., 1915, No. 116; R., 1916, No. 137; R., 1917, No. 891. (Ed.)

June it would seem that a very small percentage of the larvae present in manure heaps in autumn live throughout the winter and grow to adults in spring.

CROPS AND CULTIVATION

682 - **Variations in the Moisture Content of the Surface Foot of a Loess Soil as related to the Hygroscopic Coefficient; Investigations in Nebraska, U. S. A.**—ALWAY, F. J., and MC DOLE G. R., in the *Journal of Agricultural Research*, Vol. XIV, No. 11, pp. 453-480 + 16 Tables + 5 Figs. + Bibliography of 7 Publications. Washington, September 9, 1918.

SOIL PHYSICS
CHEMISTRY
AND
MICROBIOLOGY

A study was made of the moisture variations, in each inch of the surface foot of fields attached to the Nebraska Agricultural Station, situated near the western border of the wet portion of the North American prairies. The investigations were carried out during seasons representative of the driest and wettest conditions common to the district. Four adjacent plots of loess silt loam were used, one a clean summer fallow, the second maize and the third pasture. The fourth, cleared of 3 to 4 feet of surface soil by levelling, represented but the sub-soil, free from vegetation. The degree of moisture is expressed by the ratio between the water content of the soil and its hygroscopic coefficient.

RESULTS.—The extreme values of this ratio were found in the fallow and pasture plots respectively. The maize plot gave intermediate values, and the exposed sub-soil gave results which differed completely from those of the three other plots.

Maximum ratios.—In the fallow and pasture, in the process of thawing after a fortnight without rain, the ratios found were as high as in all the subsequent periods (except immediately after heavy rain). They were almost equal in each plot, namely 3.1 and 3.2. Twelve hours after a 2.8 in. rainfall the ratios found in these two plots were 3.0 and 3.7 respectively in the first 6 inch layer, and less high, 3.3 and 2.9, in the second 6 inch layer.

The sub-soil cleared of vegetation differed markedly from the fallow, the maximum ratio being only 2.4 to 2.5.

Minimum ratios.—These were found in the surface layers of pasture during the dry periods. The fact that at this period the twelfth inch became as dry as the surface layers in as short a time showed the principal losses in water to be due to the transpiration of the plants.

In the maize plot, near the period of maturity, the water was removed uniformly from the various layers, but the ratio never fell below 1.5.

The fallow soil remained moist a few inches below the surface even during the driest periods.

CONCLUSIONS.—The distribution of moisture in the surface foot of soil depends on the preceding weather conditions and on the presence of vegetation.

The moisture ratios show that the first six inches may be a more important source of food elements than the second six inches. This is due to the depth of penetration of the rain, not to the depth of ploughing or the distribution of the roots.

683 - **Relation of Inorganic Soil Colloids to Plowsole in Citrus Groves in Southern California.** — JENSEN C. A., in the *Journal of Agricultural Research*, Vol. XV, No. 9, pp. 505-519 + 10 Tables + bibliography of 7 Publications. Washington, December 2, 1918.

In the citrus plantations of southern California where the soil is cultivated during the irrigation period, a compact layer called "plowsole" forms immediately beneath the ploughed soil. The depth of this layer may vary from a few inches to 2 feet, but is rarely more than 18 inches below the surface. The hardness of this "plowsole" varies from that of a crust to that of a layer difficult to break with a spade. Immediately after irrigation the «plowsole» is usually soft enough to break easily but becomes hard as it dries.

"Plowsoles" form in all the soils of the district studied by the author which are ploughed during the irrigation season. They do not, however, form in mulched soils which are rarely ploughed, and pressure from the ploughing machines and tools does not appear to be necessary to their formation. As plowsoles limit the growth of the roots and prevent the penetration of the irrigation water, it is important to control them. To this end the author studied their chemical composition in order to discover the true cause of the formation of "plowsoles".

RESULTS. — The "plowsole" contained no more water-soluble iron, calcium, magnesium, or silica than the ploughed soil or the sub-soil, nor, after the calcium had been removed by hydrochloric acid, did it contain more silica, iron, aluminium and phosphoric acid soluble in ammonia. The humus extract of the "plowsole" contained more colloidal silica, ferrous oxide and aluminium (but not more colloidal phosphoric acid) than the humus extract of the ploughed soil or of the sub-soil. Both the organic and mineral colloids of the humus extract moved towards the positive pole in an electric current. The "plowsole" contained more mineral colloids in suspension than did the ploughed soil and, as a rule, than the sub-soil.

When soil was put in pots, watered, and then left to dry, the quantity of colloids in suspension was much greater in the surface layer than in the lower one. This shows that the colloid content increases with the capillary moisture. No relation was found between the amount of mineral colloids in suspension and the amount of organic carbon (humus) in the soil. Unploughed soils contained far fewer colloids in suspension than similar soils which had been ploughed for several consecutive years.

The decomposition of 1 % of organic matter in the soil had no appreciable effect on the content in mineral colloids in suspension. On the other hand this content was sometimes decreased by the decomposition of 3 % of organic matter. The addition of ground lime to the soil caused a marked decrease in the content in mineral colloids in suspension when organic matter was not applied at the same time, as by doing so the flocculating action of the lime is diminished, especially in clay soils.

The application of ground sulphur and gypsum caused a marked decrease in mineral colloids in suspension and organic matter did not prevent the flocculent action. Sodium nitrate increased the quantity of mineral col-

loids in suspension, but its de-flocculent action was checked by the organic matter.

To sum up it may be said that the iron and aluminium content of the colloids in suspension in a soil is in direct ratio to the facility with which this soil forms "plowsoles".

- 684 - **Effect of Carbon Di-sulphide and Toluol upon Nitrogen-Fixing and Nitrifying Organisms.** — GAINES, P. L., in the *Journal of Agricultural Research*, Vol. XV, No. 11, pp. 601-614 + 6 Tables. Washington, December 16, 1918.

In continuation of his previous work on the effects of carbon di-sulphide and toluol on the total number of bacteria and on nitrification in soil (1), the author studied the effect of these disinfectants on the activity of nitrogen-fixing micro-organisms and on nitrifying bacteria.

RESULTS. — If these two disinfectants are applied to the soil in sufficiently large quantities they may destroy the *Azotobacter* contained in it, inhibit nitrification, and even destroy the causal agents. The amount of disinfectant required to produce these effects varies greatly according to the moisture content of the soil and is in inverse ratio to this content.

Both disinfectants have a stronger action on the *Azotobacter* than on the nitrifying bacteria. When applied in quantities sufficiently large to exercise a marked action on the *Azotobacter* they seem to destroy these micro-organisms completely rather than only to suspend their activity. On the other hand quantities of carbon di-sulphide or toluene which are sufficiently large to kill the *Azotobacter* may not suffice to inhibit nitrification. Finally the amount of these disinfectants required to kill the nitrifying bacteria greatly exceeds those capable of inhibiting their activity.

After soil has been antiseptically treated no appreciable formation of ammonia takes place until nitrification has ceased.

In addition to *Azotobacter* the soil may contain other nitrogen-fixing bacteria which are not destroyed by the maximum quantities of carbon bi-sulphide or toluene used by the author in his experiments, namely 10 cc. to 100 gm. of soil, even when the soil is very wet.

The experiments did not show that antiseptic treatment stimulates the activity of nitrifying bacteria and gave no clear proof of a stimulating effect on ammonia-forming or nitrogen-fixing bacteria.

- 685 - **Subsoiling, Deep Tilling and Soil Dynamiting in the Great Plains, U. S. A.** — CHILCOTT, F. C. and COLE, J. S., in the *Journal of Agricultural Research*, Vol. XIV, No. 11, pp. 481-521 + 4 Figs. + Bibliography of 8 Publications. Washington, September 9, 1918.

This paper gives the results of studies made of the sub-soil of 12 stations of the Bureau of Plant Industry of the U. S. Department of Agriculture. All the stations were in the Great Plains. The investigations were conducted over a period of 66 years, that is an average of $5\frac{1}{2}$ years for each station. From four to seven different crops were grown every year in each station; they were winter wheat, spring wheat, oats, barley, flax,

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AND METHODS
OF
CULTIVATION

(1) See R., May, 1913, No. 467. (Ed.)

maize, cotton, kafir, milo, broom sorghum, and sugar sorghum. In consequence of the length of time over which these investigations were conducted and the very varying climatic conditions under which they were made the results represent the most diverse conditions found in the Great Plains region.

The same crop was always grown on each plot. As a rule five methods were tested -- spring ploughing, autumn ploughing, summer fallow alternating with a crop, ploughing of the subsoil, and listing. The plots ploughed in autumn were compared with those of which the sub-soil was ploughed, this being the only difference between them. The results are set out in tables and discussed separately for each district. They may be summarised as follows: —

Ploughing the sub-soil, deep ploughing, and breaking up the sub-soil with dynamite, raise the cost of production above that of ordinary ploughing. These methods also increase the amount of labour per surface unit, that is to say they diminish the surface which can be ploughed by a unit of labour. Ploughing the sub-soil is as difficult and as costly as ploughing the soil, but has to be done in addition to and at the same time as this last. Ploughing to a depth of from 12 to 14 inches with a special machine demands, in comparison with ordinary ploughing, more than double the work, time, and expense. The use of dynamite, even in the smallest quantities with which satisfactory results may be obtained, requires an increase in the cost of material and labour of more than of \$ 20 per acre. In order to justify their use, therefore, these methods should give a sufficiently large increase in yield to compensate for the extra expense incurred.

In any year and at any station there may be a combination of conditions favourable to the ploughing of the sub-soil. In some stations the average results of a series of years do not show ploughing of the sub-soil to have produced appreciable effects on the crop, in some stations it clearly caused a decrease in the yield, whereas in others the yield was increased. The rare increase in yield with both ploughing of the sub-soil and the use of dynamite was in each case too slight to be beneficial.

Although in some seasons and places favourable results may be obtained by ploughing the sub-soil and other methods of deep ploughing, the average yields obtained by the authors in their numerous experiments show that, as a rule, no increase in yield or improvement in conditions may be expected from deep ploughing in the Great Plains.

There was no marked difference in the response of the different crops to deep ploughing. Deep ploughing and ploughing the sub-soil are of no value as methods to avoid injury caused by drought; on the contrary, they may cause a decrease in yield in years when the crops are below the average.

The sub-soil plough, the Spalding deep-tillage machine, and dynamite were tested. The effect, or rather the lack of effect, of deep ploughing was essentially the same whatever methods were used.

The conclusions given were drawn from experiments on a large scale, including very varied crops, soils, and conditions in the Great Plains region. Experiments carried out in the Great Basin under semi-arid conditions, with

practically the whole of the rainfall during the winter months; under wet conditions in the States of Illinois, Pennsylvania, and Mississippi; under semi-arid conditions at San Antonio, Texas; and under semi-arid conditions in the black soils of South Russia, all lead to the same conclusion, namely that ploughing deeper than is customary does not increase the yield or decrease the effects of drought.

686 - **Electroculture Experiments at Llantwit Vadre, Wales.**—I. ALLAN, C. T. *The Electrical Review*, Vol. LXXXIII, p. 536-537, London, Dec. 6, 1918 — II ID *The Electrician*, Vol. LXXXIII, p. 95-99, London, Jan. 17, 1919 (1)

The experiments described were carried out by The South Wales Electrical Power Distribution Co., an area of 2,07 acres being used for the purpose. The crop consisted of various kinds of potatoes, and experiments were carried out both in 1917 and 1918. The pressure was stepped up to 32 000 volts and rectified with a Decon type of rectifier which held the voltage to 39 000 in dry weather and 30 000 in wet weather. In 1917 the wires were placed 6 feet apart with cross wires arranged 6 feet apart. The height from the ground was about 6 feet 6 in., afterwards reduced to 5 feet. In 1918 the wires spaced 9 feet apart, with no cross wires, and the network was kept as nearly as possible 2 feet above the haulms. In 1917 the current varied from 2.5 milliamperes in dry weather to 4.0-7.0 in wet weather; in 1918 it varied from 0.35 in very dry weather to 0.8 during heavy rain. Treatment was usually given between the hours of 6 and 9 in the morning and 7 and 10 in the evening. The yield in 1917 showed an increase of 17.2 % over the control and in 1918 12.6 %, the crop in 1918 being somewhat heavier than in 1917. It is suggested that the decrease may be explained by the smaller area of network in 1918. The cost of the transformer and rectifier was £300 and the overhead equipment cost £12 8s. It is estimated that the transformer and rectifier equipment could easily deal with 100 to 150 acres.

687 - **Determination of the Value of Agricultural Lime.** CONNOR, S. D., in *The Journal of Industrial and Engineering Chemistry*, Vol. X, No. 12, pp. 996-999, Easton, Pa., December 1, 1918

MANURES
AND MANURING

To determine the value of agricultural lime and calcareous fertilisers in general three methods were adopted:— 1) determination of the percentage of calcium and magnesium; 2) determination of the carbon dioxide; 3) determination of the neutralising power to acids.

Pot experiments with wheat and clover grown in very acid soils showed the value of agricultural lime to be proportionate to its power of neutralising acidity rather than to its content in lime, magnesium or carbon dioxide. The neutralising power may be determined by boiling 1 gm. of the sample analysed with 6 cc. N/4 hydrochloric acid and 75 cc. of water for 15 minutes, and titrating the excess of acid with an N/2 solution of caustic soda, using phenolphthalein as an indicator.

(1) See *R*, Jan., 1918, No. 10. (Ed.)

The results, expressed in percentages of calcium carbonate, show certain magnesites and dolomites to contain an equivalent of calcium carbonate exceeding 100 %.

With regard to their effect on the growth of crops the different calcareous or magnesia materials may be classed in the following order : — calcite, dolomite, magnesite, wollastonite, rock phosphate, serpentine, enstatite, gypsum. The order in which the materials diminish the acidity of the soil is as follows: — magnesite, dolomite, calcite, wollastonite, serpentine, rock phosphate, gypsum, enstatite.

688 - **Effect of Farm Manure in Stimulating the Yields of Irrigated Field Crops.** — SCOFIELD, C. S., in the *Journal of Agricultural Research*, Vol. XV, No. 9, pp. 493-503. Washington, December 2, 1918.

The experiments described were carried out in three stations with irrigated soil under semi-arid climatic conditions, in order to study the effect of farmyard manure on the production and quality of sugar beets and potatoes. The experiments lasted six years, from 1912 to 1917, in rotations of two to six years with oats and alfalfa. The manure was applied at the rate of 12 tons an acre for each rotation.

The application of manure to potatoes increased the crop by about 40 bushels an acre, and at the same time raised the proportion of marketable potatoes by 8 %. The yield of sugar beets was also raised by 4.3 tons without any appreciable increase in the percentage of sugar. In five out of seven rotations the manure was applied to the experimental crop, and in two others to the preceding crop. In both cases the beneficial action of the manure is appreciable for two years or more after its application, both for the crops studied and for the other rotation crops.

689 - **Value of Bracken (*Pteris aquilina*) as a Fertiliser.** — SHUTT F. T., in the *Agricultural Gazette of Canada*, Vol. VI, No. 4, pp. 328-329. Ottawa, April, 1919.

Common bracken (*Pteris Aquilina* L.) grows in large quantities in Canada, especially in the neighbourhood of the Pacific Ocean. A long time ago already the author drew attention to the value of bracken as a fertiliser. The plants also make excellent bedding material, largely on account of their capacity for absorbing liquids and ammonia. Bracken litter used as a fertiliser has the same value as straw litter.

An analysis of air-dried bracken made in 1918 at the Agassiz Agricultural Station, British Columbia, gave the following results: — Moisture 6.09 %, ash, 7.84 %, nitrogen 1.84 %, phosphoric acid 0.68 %, potash 2.75 %.

Analyses made in the United Kingdom showed the ash of young bracken to contain 50 % of potash. Its high nitrogen content gives bracken a good fertilising value.

The bracken is gathered in autumn and, if the weather conditions permit, even in winter. It should be noted that dried bracken rapidly loses its potash.

Recent investigations carried out in the Zootechnical branch of the Department of Agriculture of Canada showed that dried bracken present in hay

may prove poisonous to horses. The best use to which bracken can be put is, therefore, to employ it as litter and to apply the litter as fertiliser. Green bracken may also be mixed directly with other fertilisers, or else burnt and the ashes utilised.

690 - **The Industrial Use of Locusts as Manure in Uruguay.** — *Revista de la Asociación Rural del Uruguay*, Year XLVII, No. 7, pp. 363-370 + 5 Fig. Montevideo, 1918.

Report of the Commission nominated by the Minister of Industry of Uruguay on experiments carried out for the use of locusts as manure. Drying-rooms were used: the locusts, put into a hopper, were carried by an endless band into suitable ovens whence they came out almost dry; the drying was then completed by exposing them to the sun. An analysis of the product obtained was made. The locusts used are known as «langosta saltona», and gave the following results (average of two determinations):—

	Result obtained from the artificial drying	Result dried at over 110° C.
Water. . .	8.93 %	
Dry matter	91.07	
Nitrogen	10.28 %	11.30 %
Total protein	64.25	70.62
Digestible protein	38.94	42.79
Fatty matter	9.39	10.31
Acidity expressed in acetic acid	3.19	3.51
Ash (total)	5.31	5.80
Ash soluble in nitric acid	1.87	2.02
Phosphoric acid in ash	0.73	0.79
Lime (in ash	0.316	0.34

The results of this analysis show that dried locusts can be used in the following ways:—

As *cattle-food*, their integral nutritive value is superior to that of oil-cake: they can then be used as supplementary fodder to fatten cattle and pigs, which eat them readily, as do horses and sheep.

As *manure*, the residue from the extraction of the fatty matter by benzine or some other volatile solvent can be employed, for it is richer in nitrogen and phosphoric acid than dried blood or powdered meat meal. In intensive cultivation each ton of this manure represents, theoretically, four metric tons of bread wheat, and eight metric tons of straw.

The fatty matter, extracted in the above manner, can be used as a lubricant. In 1918 it was worth 20 *centesimos* (1.07 *francs* at par) the kilogram.

The commission has had some modifications made in the drying-rooms in order to guarantee a good output; in addition attention is drawn to the advantages that national economy will be able to realise by the intensifi-

cation and popularisation of methods for destroying locusts in view of their industrial use. That is to say :—

(1) Given the considerable economic value of dried locusts, they encourage the co-operation of the indifferent and indolent against this serious pest ; (2) they offer to persons interested in stock breeding a partial compensation for expenses incurred in this struggle under its actual form ; (3) they relieve the national budget by a part of the considerable sums which the struggle against the locusts demands ; (4) they increase the value of landed property and encourage agricultural production in regions menaced by periodical invasions ; (5) the pest itself, undergoing a profitable transformation, covers and more than covers, by its economic value, the expenses incurred in its destruction.

691 — **Solubility of Basic Slag in diluted organic Acids.** — SIROT, M. and PORET, G., in *Annales de Chimie analytique*, 2nd Series, Vol. I, No. 3, pp. 80-85. Paris, March 15 1918.

Employing for the experiments basic slag of various grades of fineness, the authors have determined the solubility of the constituents of slag in 3 % solutions of various organic acids (after shaking for thirty minutes) for phosphoric acid and in a separate sample for sulphur

RESULTS. — The solubility of the constituents was, up to a certain point, in proportion to the fineness of each slag. The results set out in the following table concern the sample that gave 80.6 % of fineness in sieve No. 100 ; the solubility of diluted organic acids is expressed by percentages of the *total* content of each constituent

Constituent	Total content	Solubility (in percentages of the total content) in the acids					
		citric	malic	tartanic	lactic	acetic	oxalic
Phosphoric acid .	18.50	82.5 "	84.8 "	54.1 %	99.7 "	59.4 "	26.7 "
Lime	51.40	76.6	83.6	41.1	88.7	68.6	0
Silica	6.50	99.2	95.3	57.3	100.0	88.3	30.7
Iron	10.30	34.7	31.3	11.9	25.5	15.3	23.3
Manganese	4.00	27.5	25.0	15.5	22.5	14.5	13.4
Magnesium	3.00	21.0	31.3	5.0	25.0	19.0	traces
Sulphur	0.48	43.7	47.9	—	—	33.3	—

CONCLUSIONS. — Basic slag contains, in an eminently soluble form, a great variety of elements which are of fertilising value, some *plastic*, that is to say necessary for the normal formation of plant tissues (phosphorus, lime, silica, magnesium, etc.), the others *diastatic*, that is to say capable of favouring, solely by their presence, intimate transformations (manganese, sulphur).

Basic slag can therefore be considered, up to a certain point, as a true compound manure, thus explaining more or less the differences in effect shown by slag having the same value of total and soluble phosphoric acid.

692 - **The Solvent Action of Dilute Citric and Nitric Acids on Rock Phosphate.** — STENIUS, J. A., in *The Journal of Industrial and Engineering Chemistry*, Vol. XI, No. 3, pp. 224-227 + 6 Tables. Easton, Pa., March, 1919.

CITRIC ACID. — A study was made of the solvent action of citric acid in five different solutions varying from 0.2 to 0.5 %. Three grammes samples of mineral phosphate were shaken for 30 minutes in a shaking machine with 100 cc. of citric solution. The liquid was then diluted to 500 cc. and filtered. Two portions of 200 cc. each were taken from the filtrate in order to estimate the phosphoric acid dissolved.

Results. — The 0.2 % citric acid solution extracted about the same quantity (0.1918 %) of phosphoric acid from the mineral phosphate as the neutral citrate solution used to estimate the so-called "assimilable" P_2O_5 (0.2 %). Five per cent. citric solution extracted more than double that quantity.

On the other hand if samples of phosphate smaller than 3 gr. (1 gr., 0.5 gr., and 0.1 gr.) are used to extract an 0.2 % citric solution, the amount of P_2O_5 dissolved is in inverse proportion to the weight of the sample. Thus, for example, 100 cc. of 0.2 % citric solution only extracted 0.1918 % of P_2O_5 from a 3 gm sample as compared with 4.289 % from an 0.1 gm. sample.

The addition of a basic substance, such as calcium carbonate, which frequently accompanies mineral phosphates, to the phosphate, appreciably decreases the solvent action of the citric solution. This decrease is not completely inhibited by the addition of a quantity of citric acid equivalent to that of the base present.

NITRIC ACID. — Its action was studied in four solutions varying from 0.015 to 0.06 %. Two grammes samples of phosphate were used and shaken for 30 minutes with 500 cc. of nitric solution.

Results. — The dilute nitric acid dissolved more P_2O_5 than the dilute citric acid, so that it is much less suitable than the citric acid for estimating the assimilable phosphoric acid of the mineral phosphates. On the other hand, the decrease in its solvent action produced by basic substances (calcium carbonate) may be completely inhibited by the addition of nitric acid in quantities equal to the base present.

CONCLUSIONS. — Both dilute citric acid and nitric acid have too strong a solvent action to make it possible to determine the true proportions of assimilable P_2O_5 in mineral phosphates. Moreover, objection may be raised to the use of dilute citric acid on account of its solvent action produced by basic substances and incompletely prevented by the addition of acid.

With regard to ammonium citrate, although this does not extract the actual quantity of assimilable P_2O_5 , it nevertheless appears to give a satisfactory notion of it and to supply indications of the effect produced by certain processes which render the phosphoric acid of mineral phosphates more assimilable, on condition that determinations are carried out under uniform conditions both before and after the experiment.

693 - **Effect of Sulphofication and Nitrification on Rock Phosphate.**—¹AMES J. W. and RICHMOND, T. E., in *Soil Science*, Vol. VI, No. 5. pp. 351-364 + 7 Tables + Bibliography of 5 Publications, Baltimore, November, 1918.

Recent investigations have shown that certain bio-chemical processes, such as the oxidation of sulphur ("sulphofication") (1) and nitrification, may make the phosphoric acid of mineral phosphates more assimilable. The authors, therefore, undertook an investigation into the effects of these two processes respectively. They used four different soils:— *a*) an acid silt loam; *b*) a basic black clay; *c*) an acid peat; *d*) a quartz sand. To these were added the following substances in varying combinations and quantities:— mineral phosphate, sulphur, dried blood, ammonium sulphate, and calcium carbonate. These mixtures were moistened and determinations made of the quantity of soluble phosphoric acid and other elements present at the beginning of the experiment and after nineteen weeks' incubation.

RESULTS. — In acid soil the oxidation of the sulphur was vigorous, about half of it being transformed into sulphate. The addition of calcium carbonate to the soil somewhat decreased the oxidation. In sandy soil the presence of lime was indispensable to sulphofication, because, in the absence of other bases the calcium of the mineral phosphate was hardly capable of fulfilling the basic function necessary to the process.

In an acid soil to which no lime or other substances favourable to nitrogen transformation had been added, the oxidation of the sulphur contained in the mineral phosphate rendered about 1% of the P_2O_5 of this phosphate soluble in neutral ammonium citrate. In acid soil to which lime had been added sulphofication had practically no solvent effect on mineral phosphate.

In basic soil the acidity resulting from sulphofication was partly neutralised by the calcium present in the form of carbonate or other compounds, so that the solvent action of the mineral phosphate was much slighter than in acid soil.

The very weak solvent action of ammonium sulphate in acid soil is much more to be attributed to the sulphate ion than the biochemical process, nitrification being possible in a soil poor in bases only after the addition of lime.

The nitrification of ammonium sulphate and dried blood, active in soils of normal composition, only had a slight solvent action on the mineral phosphate. In the same way nitrification was stimulated very little by the phosphate.

In the absence of mineral phosphate or calcium carbonate the nitrification of the dried blood and the peculiar action of the ammonium sulphate described above, increased the amount of water-soluble calcium at the expense of the soil itself. This would seem to show that the non-carbonated calcium of the soil (silicates and other compounds) is attacked almost as quickly, if not quite as quickly, as the mineral phosphate.

(1) See *R.* Jan. 1919, No. 24. (*Ed.*)

- 694 - **Experiments on the Value of Greensand as a Source of Potassium for Plant Culture.** — TRUE R. H. and GEISE, F. W., in the *Journal of Agricultural Research*, Vol. XV, No. 9, pp. 483-492 + 2 Tables, Washington, December 2, 1918.

The authors consider the green sands or green sand marls of the United States to be composed principally of glauconite (amorphous hydrated silicate of iron and potassium) with or without fossil detritus. Their composition is — Calcium oxide 0.33 to 12.50 %; phosphorus pentoxide 0.16 to 1.25 %; sulphur trioxide 0 to 0.50 %; total potassium oxide 1.52 to 7.63 %; potassium soluble in dilute hydrochloric acid 1.35 to 6.80 %.

The authors tested the fertilising values of these substances as compared with those of various potassium salts in sand and water cultures of wheat and clover grown in pots. The experiments lasted two months.

From the results obtained it appears that green sands and green sand marls are capable of supplying adequately the potassium requirement of the two crops tested during the first two months of their vegetative life. The aerial parts of the plants gave a higher yield in dry matter than that obtained with similar crops which had received potassium salts.

Exceptional results were obtained with a green sand of a so-called "poisonous" marl. Even in this case, however, the application of 1 to 5 tons per acre suffices only if 1 ton or more of ground lime be added to the fertiliser.

- 695 - **Exploitation of Mexican Guano Deposits.** — FERRY F. F., in *Commerce Reports* No. 51, p. 989 Washington, 1919

By a contract made in December, 1918, a concession was made by the Mexican Government for the exploitation of the guano deposits of the Isabela and San Juanico Islands in the Pacific Ocean. The contract, which is valid for five years, may be renewed, when it expires, for a further five years. It stipulates for an annual minimum yield of 2 000 metric tons. A due of 1.50 p/sos (4s. at par) per ton is to be paid by the lessees to the Government.

- 696 - **Experiments regarding the Use of Nitrate of Ammonia as a Manure in the United Kingdom (1).** — RUSSELL, F. J. (Director of the Rothamsted Experimental Station), in *The Journal of the Board of Agriculture*, vol. XXV, No. 11, p. 1332-1339 London, February, 1919

At the experimental station of Rothamsted (England) experiments have been carried out comparing the effect of nitrate of ammonia (96 % pure and 33.59 % of nitrogen) with that of nitrate of soda and of sulphate of ammonia on potatoes, mangolds and wheat.

The nitrate of ammonia, which is the most concentrated nitrogenous manure of the three, showed, in equal weights of nitrogen, as much fertilising value as the nitrate of soda and the sulphate of ammonia.

(1) Concerning experiments with nitrate of ammonia made in France, see *R*, August 1918, No. 847 (*Ed*)

It is best to employ it alone as a top-dressing, and not to mix it with other manures. It cannot be advised for potatoes, as it may lead to an excessive development of the tops and also produce mildew.

On the other hand, it is essential to prohibit deliquescent nitrates of ammonia which are liable to set in a compact mass, difficult to break up, and also those which contain as impurity more than 1 % of trinitrotoluene (quantities of this substance of less than 1 % do not appear harmful). Agriculturists must then make sure that the nitrate of ammonia which they buy is not defective in this way, and that it corresponds properly to the guarantee "not deliquescent".

Finally it must not be forgotten that if nitrate of ammonia is not itself combustible, it makes very inflammable, by way of compensation, receptacles (sacks, barrels, etc.) which are impregnated with it, and greatly favours the combustion of burning matter.

This shows the need of special precautions against risk of fire in places where this fertiliser is stored.

Other experiments (made at Aberdeen, Scotland on natural meadows and on oats, and at Newton Rigg on mangolds) have given results similar to those of the Rothamsted experiments.

697 - Comparative Trials of Various Nitrogenous Manures in Germany. — MITSCHERLICH, F. A., SANCKEN, S. N. and IFFLAND, F., in the *Journal für Landwirtschaft*, Vol. LVI, Pt. 3, pp. 187-198 + 1 Fig. + 1 table. Berlin, 1918.

Experiments with various nitrogenous manures (nitrate of soda, sulphate of ammonia, urea, nitrate of urea), on crops of oats on a sandy soil, compared with control plots without nitrogenous manures. The results have shown that urea and nitrate of urea are at least equal to other ordinary nitrogenous manures, nitrate of urea constituting an excellent top-dressing, and capable, in this respect, of replacing effectively nitrate of soda.

The authors then develop some theoretical considerations to show the error of the common idea that a given quantity of a manure should bring about a determined increase in yield; the contrary takes place, in virtue of the law of physiological ratios which has the effect, for example, that the first 10 kg. of nitrogen applied per hectare have a more efficacious action than the second 10, the latter a superior action to that of the third, and so on.

698 - Cross-inoculation of Legumes. — KOCH, G. P. and BUTLER, J. R., in *Soil Science*, Vol. VI, No. 5, pp. 397-403 + 4 Tables + Bibliography of 4 Publications. Baltimore, November, 1918.

When a mixture of various Leguminosae seeds is sown it is of great practical value to know to what extent a crop containing a single variety of root nodule microorganisms is capable of inoculating all the different seeds simultaneously, in other words, if the root microorganisms of one species of Leguminosae can be inoculated satisfactorily into another species (cross-inoculation).

To throw light on this question the authors made a series of cross-inoculation experiments with the following four groups of Leguminosae:

I. — ALFALFA GROUP, including cultivated alfalfa (*Medicago sativa*), burr clover (*Medicago denticulata* and *Medicago maculata*), and sweet clover (*Melilotus alba*).

II. — CLOVER GROUP, including four clovers: crimson, alsike, red and white, (*Trifolium incarnatum*, *T. hybridum*, *T. repens*, and *T. pratense*).

III. — PEA-VETCH GROUP, including the garden pea (*Pisum sativum*), Canadian field pea (*Pisum arvense*).

IV. — COWPEA GROUP, including the cowpea (*Vigna Catjang*), Japan clover (*Lespedeza striata*), and the velvet bean (*Mucuna pruriens*).

RESULTS. — 1) *Bacillus radicicola*, isolated from roots of alfalfa, burr clover, and sweet clover respectively, is adapted to cross-inoculation, but the microorganisms of alfalfa and sweet clover only infected the roots of burr clover very slightly.

2) The micro-organisms isolated from the four clovers caused, when cross-inoculated, nodules as vigorous as those obtained by direct inoculation on the original plant.

3) The micro-organisms of the four plants of the pea-vetch group respectively may be used for cross-inoculation. In the garden pea and the field pea, however, the nodules produced by cross-inoculation were not so vigorous as those caused by direct inoculation of the specific organism.

4) In the cowpea group cross-inoculation produced nodules in each case except when Japan clover was inoculated with the micro-organisms of the cowpea. In all cases the roots of Japan clover produced few nodules.

699 — **Patents concerning Fertiliser.** — See No. 679 of this Review.

700 — **Chemical Constituents of the Cotton Plant.** — I. VIEHOEV, A. A., CHERNOFF, L. H., and JOHNS C. O., Chemistry of the Cotton Plant, with Special Reference to Upland Cotton, in the *Journal of Agricultural Research*, Vol. XIII, No. 7, pp. 345-352. Bibliography of 10 Publications, Washington, May 13, 1918. — II. STANFORD, E. E. and VIEHOEV, A., Chemistry and Histology of the Glands of the Cotton Plant, with Notes on the Occurrence of Similar Glands in Related Plants, *Ibid*, Vol. XIII, No. 8, pp. 410-435. 9 Plates + Bibliography of 19 Publications. Washington, May 20, 1918.

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

I. — CHEMISTRY OF THE COTTON PLANT WITH SPECIAL REFERENCE TO UPLAND COTTON. — The principal aim of the work under consideration was to isolate the substance so strongly attractive to the boll weevil (*Anthonomus grandis*) which does such great damage to Upland cotton (*Gossypium hirsutum*). It is the first of a series of studies made by the Bureau of Chemistry of the U. S. Department of Agriculture on the chemical constituents of the cotton plant. A description is given of the methods used for isolating the glucosides of the plant and of their hydrolysis products, together with an account of the preliminary investigations of an essential oil isolated from the plant which proved very attractive to the weevil. It was found that leaves and flowers from which the petals have been removed contain quercitrin and isoquercitrin. No trace was found of gossypitrin or gossy-

petine which, however, were isolated from other species and varieties of cotton.

The essential oil isolated from Upland cotton differs from that isolated from the bark of the roots of *G. herbecum*. It distils at between 200 and 300°C, leaving a black empyreumatic residue. The fractions which distil at the lowest temperatures vary in colour from yellow to greenish yellow. The colour of those distilling at higher temperatures varies from blue green to dark blue.

II. — CHEMISTRY AND HISTOLOGY OF THE GLANDS OF THE COTTON PLANT, WITH NOTES ON THE OCCURRENCE OF SIMILAR GLANDS IN RELATED PLANTS. — The glucosides, essential oil, and several other substances described in the preceding work were largely localised in the internal glands, which are very numerous in nearly all parts of the plant. A study was therefore made of the presence, formation, structure, and content of these glands. They differ distinctly from the nectaries which occupy a superficial position and are clearly localised.

The internal glands of lysigenous formation occur in the primary cortex, the leaves, flowers, and seed of Upland cotton. The secondary cortex contains glands of a similar type. Some of these are derived from the development of a single cell. In the part of the plant exposed to the light the glands are surrounded by an envelope of flattened cells containing anthocyanine and contain quercetine (probably partially or completely in the form of its glucosides, quercimeritrine or isoquercitrine), essential oil, resins, and perhaps tannins. The glands which are not normally exposed to the light are surrounded by a layer of flattened cells which contain gossypol but no anthocyanins. The gossypol forms in the glands of the growing corolla; if they are exposed to the light this body is replaced by quercimeritrine. In the opening cotyledons the gossypol undergoes a change, probably as a result of oxidation. The product formed is not quercimeritrine.

Internal glands are always present in the different species of *Gossypium*. They are also found in the related species *Thespesia*, *Cientuegosia*, *Erioxylon* and *Ingenhousia*. In addition Upland cotton has four types of glands which act as nectaries.

701 — Comparison of Percentages of Nitrogen in Tops and Roots of Head Lettuce Plants.

— NOYES H. A., in *The Journal of Industrial and Engineering Chemistry*, Vol. X, No. 8, pp. 621-624 + 2 Diagrams, Easton, Pa., August, 1918

Having found very great variations in the nitrogen content of lettuce, the author made analyses of this plant grown under glass, a) in very poor sandy soil, b) in sandy soil mixed with partly rotted horse manure in the ratio of 3 : 2, c) in fertile sandy loam, with and without the addition of horse manure, sodium nitrate, a phosphatic fertiliser, and potassium chloride.

An analysis of the different crops showed the nitrogen content of lettuce grown in various soils to differ greatly, and the various fertilisers to vary the nitrogen content of the lettuce in the same soil. The same fertiliser, however, has not a similar effect on the nitrogen content of plants grown in different soils.

In lettuces grown in fertile silt loam and those grown in sand to which manure has been added there was less difference in the nitrogen content of the roots than in that of the aerial parts. In sand to which manure has been added together with various fertilisers, to a nitrogen content equal to 100, the nitrogen content of the heads varied from 105 to 132. The nitrogen content of the heads is however, not in constant ratio to that of the root. Taking the nitrogen content of the roots as 100, the closest ratio to that of the heads was 100 : 105, and the widest 100 : 236.

Phosphatic fertiliser must be considered as decreasing the nitrogen content of the lettuce heads in the three soils and slightly increasing that of the roots grown in sand.

702 - **Researches on the Toxic Principles of the Seed and Oil of the Physic-Nut Tree (*Jatropha Curcas* L.)** (1). — HEIM, F. and RULLIER, in the *Bulletin del'Office colonial*, Year XII, No. 134, pp. 96-110 Paris-Melun, February 1910.

Experiments made at the "Service d'études des productions coloniales" of the French Colonial Office seem to show that at least two poisonous substances occur in the seed of *Jatropha Curcas*.

The first, contained in the oil, has a necrotic action when a small quantity is injected, but its effects are soon fatal for white mice injected subcutaneously with a dose of 1cc. This substance, destroyed by heating at a temperature of 100°C. for an hour, is not destroyed by being heated for 15 minutes at the same temperature.

The second is contained in the seed coat. It is not necrotic but congestive. A dose of 22.5 mgm. is fatal for white mice of 19-20 gm. in 15 to 26 hours. Insoluble in alcohol at 96°, it is soluble in water and destroyed by being heated to 100°C. in aqueous solution, even if this heating does not exceed 15 minutes.

The authors had not a sufficient weight of these products available to be able to study their nature.

Can we conclude from the facts observed that there is no toxalbumin in the seed albumen of the Physic nut tree? Although the authors' experiments were negative in this respect, they do not consider that they can give a definite conclusion on this point. It may be, in fact, that the product employed (ether) to extract the oil from the albumen has coagulated the poison of albuminoid nature, and if it exists, has made it insoluble and, consequently, it has not been observed.

703 - **Chemical Edaphism.** — AMANN, J. (Reports of meetings of the Vaudoise Society of Natural Science, ordinary meeting on November 27, 1918), in the *Archives des Sciences Physiques et Naturelles*, Year CXXIV, pp. 143-144. Geneva, March-April, 1919.

Communication on chemical edaphism, that is to say on the relations existing between the chemical and physico-chemical properties of soils and the vegetation they bear (1). The author describes the method he employs to study the chemical reaction of soils, the presence or the absence of

(1) On the subject of the oil of the Physic-nut (Pulza-Oil) see R. Sept. 1917, No. 853. (Ed.)

(1) See R., 1912, No. 1606 (Ed.)

free OH and H ions, by means of a especial indicator, " Amann's pan-chromatic indicator ", prepared by the author in his laboratory. This study permits us to distinguish, among plants and plant associations, the four following categories :

Basiphiles, growing only on soils with an alkaline reaction (OH ions) ; *oxyphiles*, growing only on soils with an acid reaction, *neutrophiles*, growing only on neutral soils ; *indifferents*, living indifferently on various soils.

As regards the demands of plants in connection with lime, it may be said that in general calciphiles are basiphiles, calcifuges are oxyphiles or neutrophiles, but the coincidence between the two series is far from perfect, and there are numerous exceptions.

Application of this new method of soil-study, simple as it is in practice, is capable of furnishing exact information regarding the requirements of plant species and associations relatively to a property of the soil which must be considered of great importance to the vital chemistry of the plant.

704 - **Influence of Environment on the Loss in Weight and Germination of Seed Potatoes during Storage.**—BUTLER, O., in the *Journal of the American Society of Agronomy*, Vol. XI, No. 3, pp. 114-118 + 3 Tables. Lancaster, Pa., March, 1919.

Potatoes generally lose from 10 to 16 % of their weight when preserved, and the tubers germinate for a long time before it is possible to plant them. The author attempted to discover what factors might be applied in order to reduce the loss in weight and retard germination, and found them to be the temperature, oxygen supply, and the moisture of the air.

At a temperature of 8.82° C. the loss in weight of potatoes increases rapidly with the number of days they are preserved, but at a temperature of 3.74° C. the loss in weight practically ceases after the 120th day. This may be attributed to the fact that the starch is rapidly hydrolysed when the temperature sinks below 8°C. thus compensating more or less largely for the losses in weight due to transpiration and respiration by gains in weight resulting from the accumulation of sugar. From the point of view of loss in weight it is, therefore, advantageous to store seed potatoes at a low temperature.

Loss of weight is, however, also partly due to respiration. Consequently a diminution in oxygen must, by reducing respiration, involve a reduction in the loss of weight. The author made the following experiment on this subject:—The tubers were placed in three narrow-necked bottles. The first bottle, closed with cotton wool, allowed free diffusion of the gases. The second was connected with a siphon which made it possible to regulate the air, 8 % of which was renewed daily. The third bottle was fitted with an apparatus similar to that of the second, but only 0.8 % of the air was renewed daily. During the experiment the temperature varied from 8 to 10°C. At the end of ninety days the air in the bottles was saturated with steam, but the tubers were sound ; those in the first bottle had germinated and lost 1.55 % of their weight, those in the second bottle had only just begun to germinate and had lost but 0.72 % of their weight, finally those in the third bottle had not germinated and had lost only 0.58 % of their weight.

It is, therefore, possible to avoid loss in weight by decreasing the amount of oxygen present, and the preceding experiment shows that asphyxia does not occur at 8° or 10° C. even when the air is only renewed at the rate of 0.8 % daily during 90 days.

The author undertook another experiment in which the tubers were exposed to an average temperature of 9.31°C. in an atmosphere poor in oxygen. Under these conditions the tubers only germinated at the end of 207 days. Germination is, therefore, more retarded by preservation at 9.31°C. in an atmosphere poor in oxygen than by preservation at 3.74°C. in a free atmosphere even though, in the second case, the losses are slighter.

The loss in weight of the tubers during storing is distinctly influenced by the moisture in the air. This is a yet more important factor than that of temperature, for whereas a lowering of the temperature from 8.82° to 3.74° only reduces loss in weight 1.8 times at the end of 120 days. A modification in the water-content of the air changing the atmosphere from a dry one to a moderately dry one reduces the loss in weight 2.7 times after the same number of days.

Both an excessively saturated and an excessively dry atmosphere must be avoided, the first because it induces too intense a transpiration, the second because it causes the vapour to condense on the surface of the tuber, thus favouring the development of moulds.

705 — **Utilisation of Glucose and Levulose by Higher Plants.** — COLIN, II., in the *Comptes Rendus de l'Académie des Sciences*, Vol. 168 No. 13, pp. 607-609. Paris, March 1919.

It is known that the reducing sugar of beet leaf offers a different composition in the blade and in the petiole the ratio $\frac{\text{dextrose}}{\text{levulose}}$ often less

than unity in the leaf parenchyma, increases all along the median nervure and the petiole. The author remarks that it is not a question of an isolated fact; indeed it is reproduced in chicory leaves and in all probability in the greater part of plants with fleshy petioles which enclose no other carbo-hydrates than crystallisable sugar and its hydrolysis products: glucose is in excess over levulose in tissues deprived of chlorophyll. If the phenomenon is general, it should be easily observable in the stems and etiolated leaves supplied by a root or a tuber with reserves of saccharose or inulin.

The author details the observations he has made on the subject on various plants:

Beet: shoots which are developed on a root sheltered from the light receive only saccharose rapidly hydrolysed; in the absence of any other active substance the extracts should thus be laevo-rotatory if dextrose and levulose were found in the same proportion; but experiment shows the contrary: in etiolated leaves glucose is more abundant than levulose.

Jerusalem artichoke: tubers of this plant (which contain inulin as well as saccharose), put into a cellar in the spring, soon give numerous etiolated stems; the rotatory power of the carbohydrate reserve is thus about 50° at 15°C, which corresponds to the proportions of 5 parts of levulose to

2 of dextrose. The sap of the stems is none the less sharply dextro-rotatory, even after the action of acids or of sucrase.

Chicory: the root of this plant is much richer in levulose than the Jerusalem artichoke tuber: in spite of this excess of levulose in the root, the etiolated leaves contain a mixture of dextrose and levulose the rotatory power of which is generally superior to that of inverted sugar.

It may be supposed that dextrose and levulose migrate with unequal speed or that they are unequally utilised (the hypothesis of isomerisation is quite gratuitous).

The concentration of the two hexoses in the cells is too small for the viscosity, and consequently the speed of diffusion, to differ much. In the preceding examples the dextrose is used up by the cells less rapidly than the levulose. It is best perhaps to adopt the hypothesis of BROWN and MORRIS, according to which "glucose would be burned in the cell in preference to levulose, this latter playing the essential part in the building up of tissues". In reality, it is known that respiration is less intense in the petiole than in the blade, in etiolated leaves than in green leaves.

706 - **Researches on the Comparative Development of the Lettuce in Sun and in Shadow.**—DANIEL, L., in the *Comptes Rendus de l'Académie des Sciences*, Vol. 168, No. 13, pp 604-607. Paris, March 31, 1919.

Certain wild plants exposed to attenuated light undergo modifications which vary with the species: the internodes are so much the longer as the light is feeble, the inflorescence is more straggling in the shade, the reproductive function is impeded or even annihilated, the form of the leaves may be modified, etc.

The author has set himself to find out how lettuce behaves in full light and in half shadow, in the heart stage and when going to seed, when the harmony of other factors of growth is ensured, or when, on the contrary, the supply of water varies. He made experiments in 1917, a normal year, and in 1918, a year with a dry summer, with lettuces grown from seed from a single plant (sprung from a strain selected carefully for 15 years). These were planted in soil having the same chemical and physical composition, some exposed to the sun, some in a half light.

The author states in detail his observations and results. Attenuated light transforms orbicular leaves into elongated leaves, and is more harmful to the formation of the heart the more the light is reduced. If an optimum is realised for the other factors of development, lettuce behaves just as other plants submitted to attenuated light, and there is a very distinct correlation between the respective developments of vegetative and reproductive equipment. If the supply of water is reduced, the inhibitory action of light on growth, is, in half shadow, compensated more or less quickly, then annihilated, size is reduced, and at the same time the sexual reproductive faculties are rapidly weakened.

Within the limits of the optimum of light, light permits the attainment of maximum development only on condition of assuring complete harmony of other factors, and in particular the supply of water. This harmony

seldom exists at the sea-side, where the spurts of vegetation are more intense and more frequent than inland, and when the plant does not succeed in establishing it, its size is reduced and its cycle of development is shortened. Dwarf size, short life of species on dunes and down, and the necessity for them to grow only in spring and autumn, are due to excess of light and heat combined with rapid shortage of water at the beginning of the dry periods. Phenomena of giant growth, frequent at the sea-side, especially, in deep humid valleys, and variations in the size of species with seasonal dimorphism are generally due to variation of light and water supply during the growing season, other conditions being equal. In this way the predominance of vegetative reproduction and the weakening of the sexual value among certain species can be explained. The author also remarks that those phenomena are more frequent and more intense near the sea than inland.

707 - **Respiration of Stored Wheat.** -- BAILEY C. H. and GURJAR A. M., in the *Journal of Agricultural Research*, Vol. XII, No. 11, pp. 685-713 + 7 Figs. + Bibliography of 19 Publications. Washington, March 18, 1918.

The storage of large quantities of grain demands methods not only for the control of parasites, but also for the control of damp which causes the grain to become heated and to rot. This fact has been known since pre-historic times, but only at the present time has it been proved to be due to respiration.

At the Minnesota Agricultural Station the authors made a special study of the respiration of grain which they define as the production of energy caused by biochemical oxidation of the organic compounds hastened by certain enzymes. As grain is a bad conductor of heat, the calorific energy produced by respiration accumulates within the mass in quantities proportionate to this respiration, causing an increase in temperature which may be very high.

The amount of heat produced by respiration was determined by measuring the amount of carbon dioxide given off, thus making it possible to estimate the respiratory intensity by TRUOG's method. For this purpose TRUOG's apparatus was slightly modified. The results, expressed in milligrammes of carbon dioxide produced in 24 hours by 100 grm. of dry matter, are collected into tables and represented by diagrams. The respiratory intensity was studied in its relation to various factors — moisture of the grain, plumpness of wheat grains, density and relative soundness of the grain, period of dampness, i. e. period during which wheat is exposed to an excess of moisture, temperature, amount of carbon dioxide accumulated, respiration in an oxygen-free atmosphere.

The results obtained confirm those of other workers and show the spontaneous heating of damp grain to be caused by the biological oxidation of dextrose and other reducing sugars, and that the greatest expenditure of energy must occur in the tissues in which this oxidation is necessary to the formation of new organic compounds. This is why respiration is either especially vigorous within the embryo or else limited to it.

Moisture is one of the determining factors of respiration and determines the relative rate of diffusion between the various tissues of the grain. Any increase in the moisture content of the grain, therefore, causes a corresponding increase in the rate of diffusion and, at the same time an intensification of respiration. The increase is gradual and fairly uniform so long as the moisture content does not exceed 14.5 %. When this percentage is exceeded, as in the case of plump spring wheat, the increase rises abruptly.

The density of wheat seeds generally increases with the gluten content. Gluten absorbs by imbibition more water than does starch. Consequently different percentages of gluten result in different degrees of viscosity for the same moisture content. The relative viscosity influences the rate of diffusion which, in its turn, has a direct influence on the intensity of respiration. For this reason, when the moisture content is equal, soft wheats rich in starch respire more intensely than hard wheats of glassy structure.

A comparison of very full seed with shrivelled seed shows that the respiratory intensity of wheat is influenced by its plumpness. The respiratory intensity of shrivelled wheat is twice or three times that of the full seed when the moisture content exceeds 14 %. Below this figure the difference is not very marked. The great acceleration in the respiration of seeds containing more than 14 % of moisture may be attributed to the higher ratio between the germ and the endosperm involving a higher ratio between the enzymes and substratum.

The duration of the period of dampness, or period during which the wheat contains an excess of moisture, is in relation to the respiratory intensity. It may be calculated by comparing the respiration of wheat which has just been moistened with that of naturally wet grain or with that of grain moistened and stored for various periods of time. The respiration curve differs from that of wheat which has just been moistened when the moisture content exceeds 12 %, and the difference is still more marked when the content reaches 13 %. In the case of wheat dampened and then stored the amount of carbon dioxide given off during respiration is in proportion to the number of days during which the wheat has been stored.

The temperature at which the wheat is stored influences the intensity of the diastatic action, thus increasing the amount of substratum available for the respiration enzymes. This is proved by the stronger respiratory intensity of wheat stored at an ordinary temperature as compared with that stored at outdoor temperature during the winter.

The injury done to wheat seed by frosts while the plant is still green results in greater respiratory activity of the seeds after threshing. This was proved by a comparative examination of strongly or slightly frostbitten wheat and sound wheat. The greater respiratory activity of the frozen seed is attributed by the authors to inhibition of the synthesis processes produced by the frost and the subsequent activity of the hydrolytic enzymes during thawing.

The accumulation of glucose as a result of the hydrolysis of the starch supplies the respiration enzymes with a larger quantity of substratum.

Raising the temperature up to 35°C. hastens respiration. The diastatic action exercised on the starch is intensified by raising the temperature, but above a certain point it is reduced.

An accumulation of carbon dioxide in the respiration chamber decreases the respiratory intensity. The average intensity of respiration during consecutive four-day periods is greatest during the first period and decreases considerably during the following periods. In an oxygen-free atmosphere respiration is reduced. The ratio between respiration under these conditions and that which occurs in a normal atmosphere is about 1 : 2.5.

708—**Comparative Transpiration of Maize and the Sorghums.** — MILLER E. C. (Department of Botany, Kansas Agricultural Experiment Station) and COFFMANN W. B. in the *Journal of Agricultural Research*, Vol. XIII, No 11, pp. 579-604, 13 Diagr. + 2 plates. Washington, June 10, 1918.

New contribution of the Kansas Agricultural Experiment Station (1) to the study of the relations between consumption of water and formation of dry matter in maize and sorghums. The writers describe the experiments conducted at Garden City in 1916 and in 1917 to determine the relative transpiration of maize and the sorghums.

Pride of Saline maize, Blackhull kafir, Dwarf Blackhull kafir, and Dwarf milo were used in 1916; and in 1917, in addition to these, Freed's White Dent corn, Sherrod's White Dent corn, Freed's sorgo, Red Amber sorgo and Feterita were used. The plants were grown in large galvanized iron cans with a capacity of about 120 kilos of soil. The soil used in 1916 had a water content of 10 per cent and a wilting coefficient of 11.1, while the moisture content of the soil used in 1917 was 22 per cent and had a wilting coefficient of 15.1. The moisture content of the soil was kept as nearly constant as possible by the addition of water to the cans from three to four times each day during the time of the experiments. The number of plants grown in each can was reduced to one plant for each of the varieties of corn, Blackhull kafir, and Red Amber sorgo, while the number of plants of Dwarf milo, Feterita, Dwarf Blackhull kafir, and Freed's sorgo varied from one to three to each can.

The transpiration was determined in most of the experiments every two hours from 7 a. m. to 7 p. m. Each experiment extended through two or three days. The cans were weighed on scales of the platform type with a carrying capacity of 180 kilos and were sensitive to about 5 gm. In 1916 the cans were placed in the open on the surface of the ground, but in 1917 they were placed in a pit in the centre of a plot that was planted with maize. The pit was of such depth that the tops of the cans were on a level with the surface of the ground.

The amount of water transpired per plant in a given period stood, with the exception of Dwarf Blackhull kafir in 1917, in the same relative order as the extent of leaf surface. The amount of water transpired per plant, however, was not proportional to the extent of leaf surface. Blackhull kafir and Dwarf Blackhull kafir always had the lowest rate of transpiration per unit of leaf surface in the experiments in which these plants were used.

(1) See R. Dec. 1917, No. 1135. (Ed.)

All the varieties of maize used always transpired more water per plant during any given period than any of the sorghums. Their rate of transpiration per unit of leaf surface was, (with the exception of the kafirs), always much lower than that of the sorghums. The rate of transpiration per unit of leaf surface for Feterita, Dwarf milo, Freed's sorgo, and Red Amber sorgo was much higher than that of the maize plant under the same conditions. This difference in the transpiration rate of maize and the sorghums was more marked when the plants had reached their full leaf development and the difference in leaf surface of these plants had reached a maximum. The difference in the transpiration rate per unit of leaf surface was also more evident under severe climatic conditions than under conditions where the evaporation was low.

The results of these experiments with maize and the sorghums seem to indicate that in most cases a small leaf surface is the most important factor in reducing the loss of water from these plants. The maize plant is not capable of supplying its large extent of leaf surface with a sufficient amount of water to satisfy the evaporating power of the air, and as a result its rate of transpiration per unit of leaf surface falls below what it would be if the needed amount of water was supplied. The sorghums, on the other hand, with their small leaf surface are able to supply water in amounts sufficient to satisfy the evaporating power of the air, and as a result, their rate of transpiration per unit of leaf surface is higher than that of the maize.

709 - **Sterility in the Strawberry.**—VALLEAU W. D. in the *Journal of Agricultural Research*, Vol. XII, No. 10, pp. 613-669 + 4 Figs. + 6 Plates + Bibliography of 44 Publications. Washington, March, 11, 1918.

The investigations described were made during the four years 1913-1917 at the Agricultural Station of Minnesota with the object of finding a plausible explanation of the abortion of pollen so frequent in plants of hybrid origin. Sterility of the pistil and abortion of the anther, which result from a strong tendency of the *Fragaria* genus to dioecia were also studied in wild species and cultivated varieties of strawberry.

All parts of the flower of the *Fragaria* genus are pentamerous with the exception of the pistils. The stamens are arranged in three whorls: 1) The external parapelalous series of ten stamens; 2) the centre antipetalous series of five short stamens; 3) the internal antisepalous series of five stamens. The increase in the number of stamens is caused by an addition of five (or multiple of five) stamens to the antisepalous or antipetalous series, while the decreases in this number are due to the disappearance, first of the antipetalous series, then of the antisepalous series. The parapelalous series appears to be constant. The decrease in the number of the stamens is in no way connected with dioecia. There is, however, a positive correlation between the position of the flower, the number of its parts and the size of the fruit.

The wild species of *Fragaria* of North America, from which the strawberries cultivated on this continent are derived, are mostly diecious. The pistillate plants bear staminodia which rarely reach the stage of pollen

mother cells. The staminate plants, however, bear pistils which, at first sight, appear perfect, but which are rarely capable of functioning.

In a few wild *Fragaria Virginiana* plants which appear sterile the development of the pollen continues to the stage at which the tetrads divide, or a little beyond this stage, to the liberation of microspore, when the contents of the anthers are completely broken up into an oily mass. In other cases part of the microspores of an anther develop normally and the other part is subjected to the disintegration already described. Finally, in other plants, soon after the liberation of the microspores, which is followed by their very slight development, there is a complete abortion of the pollen of the same type as that of the hybrids.

In wild strawberries these types all seem to express, in different manners, a tendency to dioecia, and no hybridisation occurs. Similar types of anthers are common in certain cultivated strawberries on the first flowers of an inflorescence, specially at the beginning of the season.

There is a correlation between the position of the flowers and the fertility of the pistils. The fertility decreases in the last flowers of an inflorescence to open. The sterility of the pistils causes the production of fruit irregular in shape, or even the complete absence of fruit (completely sterile flowers). The sterility of the late-opening flowers of an inflorescence is more general in hermaphrodite flowers than in those having pistils only. This seems to show that hermaphrodite flowers are derived from staminate flowers of dioecious wild varieties.

In wild *Fragaria Virginiana* and *F. Americana* types considerable quantities of aborted pollen are rarely found except in the anthers of the intermediate type. On the other hand most of the cultivated varieties of these two species produce abundant aborted pollen of the type common in hybrids. The percentage of aborted pollen grains is not constant either in the different flowers of one variety or in the different anthers of one flower, but seems to vary as much in the second case as in the first.

In varieties of strawberries with a high percentage of aborted pollen there occur a certain number of morphologically normal pollen grains capable of functioning. This has been proved by germination tests and fertilisation tests with subsequent isolation of the flowers in bags. There is no proof of the physiological self-sterility of the *Fragaria* genus.

In the partially sterile variety, Minnesota 3, the pollen develops normally till the microspores separate from the tetrad. At this moment all the microspores appear normal and similar, but later variations appear, in their rate of development, the period of their division from the nucleus and their individual capacity for normal development. At all the stages of their development microspores are found in various states of abortion. In *Fragaria Virginiana*, however, development is as regular after the liberation of the microspores as previous to it.

This marks the beginning of a gametophytic generation independent of the metabolic development processes. The individual microspores float in a homogeneous nutrient medium supplied by the sporophyte, but the utilisation of this food in the metabolism of the cell depends on the individual organisation of the microspores.

Many workers have shown that the specific combinations of chromosomes are a powerful positive or negative factor in the individual development of plants and animals. In plants such as strawberry varieties, heterozygous for many factors, numerous new chromosome combinations occur for the first time in the microspores. The differences observed in the rate of growth, in the period of division of the microspores, in the growing capacity of the cytoplasm, and also, in many cases, in the incapacity for normal development, appear to be the external manifestation of differences in the capacity of these new chromosome combinations to cause the metabolism of the cell to progress.

**PLANT
BREEDING**

710 - Foundation of a Selection Station auxiliary to that of Svalöf in Jämtland, Sweden.

— SÖDEN, J. F., in *Sveriges Utsädesförenings Tidskrift*, Year XXIX, Pt. 1, pp. 24-27. Malmö, 1919.

The foundation of this auxiliary Station (situated in the commune of Ås, to the north of the town of Östersund) with buildings and experimental fields of its own, supplies a great need and will certainly have an advantageous influence on the agricultural development of Jämtland.

In this region the work of selection depends upon two series of factors :

1) *Agrological factors.* — The greater part of the agricultural soil of Jämtland comes from the weathering of Silurian rocks ; it is rich in lime, fertile, and favourable to the development of cereals and fodder plants, provided that types which are early and resistant to cold are to be obtained.

2) *Climatic factors.* — During the summer differences of temperature depend much more on altitude than on latitude ; so that thermic contrasts are much greater between the plain region in the east and the hilly region in the west than between the extreme districts of the south and north of the province.

An idea of the distribution of crops in Jämtland can be obtained from the appended Table, which indicates also, by way of comparison, how crops are distributed in the region of Norrland and in the whole of Sweden.

In Jämtland the principal crops are fodder plants, grown chiefly in artificial meadows, which give large yields, thanks to the richness of the soil in lime. One of the obstacles to the extension of the cultivation of the best fodder plants, for instance clover, is the harshness of the climate, which often seriously diminishes the crop.

Another great inconvenience is the use of seed coming from the south of Sweden and sold without any guarantee of origin or purity. One of the principal tasks of the new Station then will consist in selecting types of clover and other fodder plants which are especially suited to local conditions ; to augment their earliness and resistance and to supply agriculturists with trustworthy guaranteed seed (*see table pag. 663*).

The cereal most cultivated in Jämtland is barley and the favourite variety is Norrbotten 6-rowed. In some localities the Svanhals and Gullkorn varieties have been introduced, but they are generally too late, and are consequently exposed to the first autumn frosts before having attained maturity. In the work of selection the chief object must be earliness even if it is obtained at the expense of productivity.

Crops	Province of Jamtland	Region of Norrland	Whole of Sweden
Fodder plants	72.0 %	62.1	33.4 %
Spring cereals	10.6 / 13.8 barley 2 4 oats	25.5 / 15.1 barley 9.4 oats	31.3 / 16.6 barley 21.3 oats
Winter cereals	1.0	1.7	13.2
Roots	3.7	4.3	6.9
Various	4.0	2.8	5.9
Knut trees	0.8	1.6	0.3
	100.0	100.0	100.0

711 - Selection Work with Winter Wheat at the Station of Ultuna, Sweden. — TORSSSELL, R., in *Sveriges Utsädeförenings Tidskrift*, Year XXIX, Pt. 1, pp. 10-13. Malmö, 1919.

The auxiliary Station of Ultuna (to the south of Uppsala) serves the region of Mälaren, the lower zone of the territory of Delarne and the southern districts of Gästrikland.

Among the plants submitted to selection and hybridisation, winter wheat holds one of the first places and its cultivation could be extended with advantage over vast expanses of good wheat land.

The climatic conditions, on the contrary, are very unfavourable; the shortness of the growing season constitutes a serious obstacle to the work of the selector, who must limit the choice of material for study to the most early types.

For a long period numerous comparative cultural experiments have been made with some of the best wheats obtained at Svalöf, such as: Renodlad Squarehead, Bor, Ris, Igris and Pudel, which have given good results; but finally these have been totally replaced by the new types of the Thule series, created specially for Mid Sweden.

From the beginning of the work it was seen that, to arrive at positive results, it was necessary to have recourse to the old pubescent native wheat, which has a high degree of resistance to cold and at the same time is very early ("gamla hårdiga ludna lantvetet"). In the work of selection the following two methods have been pursued: - (1) genealogical selection (by pure lines) of native wheat; (2) crossing of this wheat with exotic wheats remarkable for their high productivity.

WORK OF CROSSING. - In 1905, at Svalöf, a beginning was made by crossing native wheat and Pudel (this last relatively resistant to cold and a good producer); from these crossings the series of Thule wheats is derived.

In 1914, after four years of cultural experiments at Ultuna, Thule was put on the market and, in 1917, another type appeared, produced by subsequent selection from the same material, that is to say Thule II.

Thule I and Thule II were both created at Svalöf, but meanwhile some of the experimental seed taken to Ultuna to be submitted to

selection gave rise to new and valuable types, notably Svea wheat, still more resistant than Thule II to the severity of winter. All these newly created varieties, although very good from the point of view of yield, of strength of straw and of resistance to rust, are not yet so early and resistant as the native varieties.

In order to obtain types which, while retaining the productivity of Thule II, possess to a higher degree the resistant character of native wheat, rehybridization of Thule with this native wheat has been carried further.

The products of this crossing are at present under examination ; and so far they are considered very promising.

GENEALOGICAL SELECTION. -- In resistance to blight, strength of straw, and productivity, the native types, while leaving on the whole much to be desired, present great, individual differences both fixed and transmissible, which give opportunity for improvement by direct selection.

The native wheats of Svalöf selected from pure strains (the "Svalöf renodlade Sammetsvete") are worthy of note, although the best types have not yet been put on the market.

At Ultuna numerous strains and families of native wheats derived from various provinces of Sweden, as far as Norrland, are on trial. For example, wheats from Filholm, Törnerud, Latorp, native wheat from Värmland and Västernorrland. These last two have given the best results. They are distinguished, in fact, from common native wheat ("vauliga Sammetsvete") not only by their greater productivity, but also by a higher degree of resistance to rust (especially Västernorrland) and by the strength of the straw (especially Värmland).

Improved native types, which can be classed among good wheats, offer excellent material for further work of selection and hybridisation. Several crosses have already been made between these types and the Sven and Thule varieties at Ultuna, and the products of the crossing are at present under examination.

The following are some comparative data on the productivity of Ultuna wheats furnished by a series of cultural experiments :

Varieties of Wheat	Kg. of grain per hectare	Relative
		index of productivity (Sammetsvete = 100.0)
Bore.	2180	79.2
Thule II	2825	103.2
Sven.	3130	113.8
Indigenous of Latorp	3010	109.4
" " Värmland	3120	113.3
" " Västernorrland	3095	112.5
Svalöfs Sammetsvete	2755	100.0

Sol (a high producer) and Pansar (very resistant to rust), cannot, by reason of the climate, penetrate into Svealand, but it may well be that, in the future, with suitable recrossing, these excellent wheats may become more resistant, and be able to withstand the climatic conditions of Mälaren.

712 - Hybridisation and Selection of Wheat, Oats, and Barley in the Interior of Alaska (1). — GEORGESON C. C., I. Wheat, in the *Report of the Alaska Agricultural Experiment Stations, 1917*, pp. 23-25, 43-46 and 63-65. — II. Oats *Ibid.*, pp. 25-26; III. Barley, *Ibid.*, pp. 46-49, p. 62. Washington, 1919.

I. — **WHEAT.** — The results are given of a series of experiments on acclimatation, selection, and hybridisation of different varieties of spring and winter wheat in the interior of Alaska, at the stations of Rampart in the Yukon Valley, and Fairbanks in the Valley of the Tanana, a tributary of the Yukon.

Winter wheat. — In both centres the results of the experiments with winter wheat were definitely negative. During the winter of 1917 Khar'kov wheat, the sole variety of which some hope still remained, was completely destroyed by the cold.

Spring wheat — For spring wheat the situation is better, and contrary to all expectations, the results of the last years gave better hopes for the future. Romanov and Marquis wheats, which, however, deserve to be subjected to new tests, were left aside, and attention concentrated on the recently-introduced Siberian types. The H. G. and Chogot varieties, are both extraordinarily early wheats (90 days' vegetative period) and are able to ripen their seeds regularly every year. In 1917 Chogot proved earlier than Rampart and H. G. at Fairbanks. Although it was not possible to realise a subsequent improvement, the results obtained with these Siberian wheat, are already such as to assure a good grain harvest each year, even in these high latitudes.

Of the hybridisation tests made to unite in the best proportions the characters of earliness, productivity, and good quality of grain, the most promising results were obtained with the crosses Chogot \times Marquis and Chogot \times Romanov. In each case the hybrids were earlier than the latest parent (Romanov and Marquis), and it would doubtless prove possible to fix the characters which still have a tendency to dissociation and to obtain types particularly well adapted to the districts in question in the interior of Alaska.

II. — **OATS.** — Although Finnish Black, Norwegian, and South Dakota, all three black oats, have given relatively satisfactory results, they are still far from the desired type capable of ripening its grain each year. The degree of earliness still has to be increased.

Copperfield is a grey oat with really valuable characters. It is, however, still over-late and is thus exposed to the first autumn frosts before the ripening stage is ended.

Toholampi (a type of Finnish Black) is of fine growth and has open panicles.

(1) On hybridisation and selection of cereals in Alaska, see R., April 1918, No. 405. (Ed.)

The cross Copperfield \times Toholampi gave descendants which, though not yet fixed, are earlier than either parent. In 1917 complete ripening took place on August 20th. These hybrids have received the distinctive number of 25 a.

Very promising material (No. 36 a) was obtained by crossing Black Tartarian \times Yakoutsch (G. I. No. 498). Almost all the hybrids ripened on August 27th, 1917 (two weeks before Black Tartarian). At the same time they showed very vigorous growth and yellow, well-developed grain. In these hybrids the yellow colour of Yakoutsch was absolutely dominant over the black of Tartarian.

The series No. 25 and No. 36 represent two types of oats which appear capable of ripening regularly each year in the interior of Alaska.

Some of the No. 25, a hybrid series (Copperfield \times Toholampi) φ \times South Dakota (G. I. No. 637) are still being tested. They are very early but still far from stable. The investigations reported were all carried out at the Rampart Agricultural Station at 65° 30' of northern latitude.

III. — BARLEY. — The types of barley adapted to Alaska must be early and hull-less. The hybrid 19 b (derived from the hybrid I a \times S. P. I. No. 12 709) would satisfy these requirements very well. It reaches a height of 48 inches, has strong, stiff straw, smooth grain, and is long and straight in the ear. The absent awns are replaced by mucrons. The largest ears of the 100 variety have 70 to 78 caryopses and ripen in 106 days. This series of hybrids will be subjected to selection.

The hybrid 14 a (S. P. I. No. 19 851 \times Abyssin) is also worthy of note.

The specimens belonging to these types vary greatly in colour, from yellowish white to yellow and dark blue with purple shades. Awns are absent. Among the specimens of this series now being examined, the type 2-2-1-2 deserves special mention. It is a two-row barley with smooth grain, no awns, stiff straw, reaching a length of 46 inches, with ears over 3 inches long containing 32 thick caryopses. This hybrid will be reproduced. Another promising hybrid is the six-row 28 c (= hybrid 14 e \times Hansen). Many of the plants are bearded, but it is hoped by subsequent work to eliminate this fault whilst still preserving the best characters.

Of the numerous crosses studied only a few deserve to be retained. They are superior to the varieties tested hitherto and justify all the work expended on them.

713 - Contribution to the Technique of the Selection of Rye. — HERIBERT-NILSSON, N., in *Nordisk Jordbrugforskning*, Parts 1-2, pp 1-9. Copenhagen, 1919.

It has been found, from several hundreds of observations, that the degree of self fertilisation in rye is very low: from 0 to 5 %. It is not rare, however, to see isolated plants, submitted in consequence to compulsory self-fertilisation, behave like wheat or oats and give a relatively high percentage of setting. The frequency of these individuals may be 1 or 2 %. In such a case the character of self-fertilisation is hereditary, as is shown in the following Table, which gives data concerning three successive generations

Behaviour of the progeny of a self-fertilised rye plant as regards their self-fertility.

1913				1914				1915				1916			
Distinctive number of plant	No of flowers	No of grains	Percentage of setting	Distinctive number	No of flowers	No of grains	Percentage of setting	Distinctive number	No of flowers	No. of grains	Percentage of setting	Distinctive number	No of flowers	No of grains	Percentage of setting
27-13	371	275	74.1	170-14	50	17	34.0	178-15	180	62	34.4	20. a-16	100	18	18.0
				171-14	328	38	11.6					202 b-16	90	30	33.3
				172-14	376	55	14.6					202 c-16	84	24	28.6
				173-14	176	26	15.9					20. a-16	46	30	65.2
				175-14	10	1	10.0								
				177-14	189	99	52.4								
				178-14	113	126	59.2								
				179-14	100	68	68.0								
								32-15	70	35	50.0				
								36-15	36	23	63.9				
								38-15	68	20	29.4				
								39-15	92	30	32.6				
								44-15	97	15	25.8				
								45-15	91	26	28.6				
								49-15	192	28	14.6				

Unfortunately self-fertile plants cannot be selected as a starting point for important new varieties, by reason of a rapid degeneration of character which is observed in successive generations. Although the degree of auto-fecundity remains high, the seeds are small and deformed, the tillering is insufficient, the stems are fragile and tend to be dwarfed. Self-fertilisation and autovitality constitute in these cases two distinct characters which cannot coexist, so that a prolonged isolation from generation to generation leads to a progressive degeneration of the vitality of individuals. So much for the isolation of individuals (where each individual is always fertilised by its own pollen).

For the isolation of populations a choice is made of one plant, for example the Petkuser variety of rye. Its seeds are sown at such a distance from other populations, as to exclude contact with their pollen while individuals of the same population can easily fertilise each other. If this procedure is continued for a series of generations the same phenomenon is repeated as for isolated individuals: that is to say a progressive diminution of yield.

It must be concluded that selection by pure descent (necessitating isolation) is impossible in the case of rye.

It can now be asked whether it is possible or not to maintain vitality without sacrificing the differentiation obtained by isolation. The author thinks he has practically solved the problem by the following procedure:

by crossing two individuals of the third and fourth generation and belonging to two different strains and already very degenerated (with very fragile straw and of a height equal to half the normal), there are immediately obtained, in the first generation, robust and entirely normal descendants.

Analogous results are obtained on repeating the operation for two different, isolated populations. In this case the products of hybridisation are even sometimes endowed with a degree of productivity superior to that of the original species. It is, however, certain that with hybridisation a part of the differentiation obtained by means of isolation is lost; but this loss is so much the less acute as the degree of differentiation obtained is higher and as the contrast or incompatibility of positive characteristics is feeblér. By aid of a methodical series of hybridisations and by following the ordinary rules, there may even be created types in which the combination of the factors of productivity is better than in the two parents.

Such a procedure certainly admits of the unforeseen and can, in so far as concerns the combination of characters give entirely negative results. But other methods supplying a remedy for the diminution of vitality due to isolation, are not known up to the present.

CONCLUSIONS. - (1) A beginning is made by practising individual selection by pure strains during 3 or 4 generations so as to be able to isolate with certainty various isogenous types

(2) In a second period types are crossed to obviate phenomena of degradation which have become rapidly accentuated

(3) By the aid of successive and methodical selection the best combinations are isolated in practically homozygotic conditions

714 - **First Selection of Rice made at the Laboratory for the Study of Cereals at Saigon, Cochín-China.** — CARLE, EDMOND, in the *Bulletin agricole de l'Institut scientifique de Saïgon*, Year 1, No 3, pp 74-87. Saigon, March, 1919

This work, commenced in 1912, comprises — (1) gathering and classification of material; (2) Choice of grain; (3) genealogical selection.

GATHERING AND CLASSIFICATION OF MATERIAL. — With the collaboration of the Administrators of the Provinces and of some planters, the Laboratory of Saïgon has been able, in two years, to get together a collection of rice, which, if not complete, is at least most important, for it includes 700 to 800 varieties. As soon as it was received, each variety (accompanied by a label with particulars concerning name, source, date of collection, length of vegetative period, etc) was classified and ticketed. It was ascertained thus that the number of really distinct varieties was much smaller than at first appeared, certain identical varieties bearing different names according to the places of origin. To establish the synonymy of varieties more satisfactorily, to study each of them and at the same time select the best, a series of cultural trials was made on small plots, followed by the study of the grains obtained. The whole of these researches comprised the following series of operations:

(1) *Agricultural study*: Cultivation; Sowing time, Time of flower-

ing; Time of maturity; Duration of life; Yield per hectare; Weight of one hectolitre of grain; Weight of 1000 grains; Number of grains to the ounce of 25 grammes.

(2) *External study of the grain.* — Form, (long, medium, round); Dimensions (length, breadth); Colour of the kernel.

(3) *Study of the kernel after decortication by hand.* — Appearance of the kernel (hard or not, transparent or opaque).

(4) *Botanical and micrographical study.* — Stem; Leaves; Flowers; Ears; Germination of grain.

(5) *Chemical study.* — Research on the nutritive principles, Classification in varieties good for consumption, or suitable for the manufacture of alcohol.

(6) *Commercial study.* — Homogeneity; Weight of kernels after decortication; Weight of husk; Fitness for polishing.

CHOICE OF GRAIN. — In Cochín-China one sign of degeneration in numerous varieties, due generally to the primitive cultural practices of the natives, is the red colour of the tegument of the grain. This colouring has two principal inconveniences: (1) at the moment of maturity many red grains fall before or during harvesting, in consequence of their feeble adherence to the rachis, which may cause a considerable loss in certain cases; (2) red rice gives a smaller yield in polishing for it necessitates a greater wear of the tegument to obtain the pure white colour.

Varieties of rice with red grain may have other characteristics identical with those of the principal cultivated varieties and present only faults of red colouring and liability to fall; on the other hand the proportion of red grains may reach 100 % in certain varieties.

These facts show the necessity of eliminating all the red grains from the seed, for they reproduce this character easily; but this sorting would be too costly if it were practised on varieties containing too many red grains, it is best then to do it only when the proportion of red grains does not exceed 20 %. To this purpose the "CERTANI" table is used, by which distinction can be made between transparent grains (good seed), opaque grains, red grains, grains with deteriorated starch, etc.), which are rejected.

The operations of sorting varieties after culture, in view of their classification, have permitted the putting aside of a certain number which it was of interest to select by scientific methods. These are Huê-ky; Ra-mây; Cadung Baria; Bông-dua; Phung-tiên; Nàng-gông-trang; Tàm-vuóc; Nang-sô; Cadung-bâp; Cadung-Gocong; Nàng-meo.

These are in general varieties of rice with more or less round grains (Gocong type), which are the best for obtaining the finest rice.

GENEALOGICAL SELECTION. — Except for some differences in detail, the method employed is the same as at the agricultural Station of Tjikeu-meuh (Java).

First generation. — From a plot sown with seeds which had been already selected for several generations, the finest plants, distinguished by their vigour, their tillering, etc., were taken. They were harvested

parately, and then studied at the Laboratory to ascertain the number and weight of the panicle of each plant (tuft). Afterwards the 15 best tufts were chosen and numbered.

Second generation. — From each of the 15 numbered tufts 100 grains were sown, spaced out 20 cm. apart in every direction in a separate plot (15 plots in all). It was not thought necessary to separate these plots by intercalary crops because staurogamy does not occur naturally in rice. On the contrary, with a view to compare the plants of the 15 selection plots with those coming from unselected seeds (populations), three plots of populations were intercalated.

In all, there were obtained thus $15 \times 100 = 1500$ selected individuals, plus a certain number of plants from the populations. This material was then classified according to:— quality and dimensions of the grain; weight of 1000 grains; number and weight of the panicles for each plant.

Third generation. — From each of the 15 selection plots the four best types were chosen, and a hundred grains sown on distinct plots. There were thus $4 \times 15 = 60$ plots each containing 100 plants, which brought the total number of plants (tufts) of this generation to $60 \times 100 = 6000$. At harvest they were classified as before.

Fourth generation. — At the moment when the author wrote his article this generation was in course of development.

CONCLUSIONS. — From the 2nd. generation there has been ascertained:

(1) a very considerable improvement in the homogeneity of the grains;

(2) a slight increase in the weight of 1000 grains, and, consequently, an increase in the weight of a hectolitre.

(3) an increase of tillering, manifested by an increase of the average number of stems per 100 tufts.

(4) certain strains are sharply distinguished by much greater yields than those of the average of populations; on the contrary, in the succeeding generations it was observed that this special characteristic of heavy yield in a given descent had no great fixity.

In the 3rd. generation, by comparing the yields given by all descents in the preceding generation, it has been already possible:

(5) to classify the strains which appear to have most fixity from the point of view of heavy yield.

In the 4th. generation it will be possible:

(6) to isolate a certain number of choice strains.

715 — **Character Inheritance in the Cowpea.** — HARLAND S.C., in the *Journal of Genetics*, Vol. VIII, No. 2, pp. 101-132 + 1 Fig. + 17 Tables + Bibliography of 7 Publications. London, April, 1919.

The inheritance of the following characters was studied in the cowpea (*Vigna sinensis* Endl = *V. Catjang* Walp.) ;—

I. — Colour of the flowers.

II. — Shape and design of the marking of the spermoderm.

III. — Colour of the spermoderm.

I. — COLOUR OF THE FLOWERS. — There are three principal types of colour :

1) *Dark type*. — Strong anthocyanine content producing a predominant, more or less dark, reddish violet colour which affects the standard and the wings more especially. The corona is usually colourless but sometimes has slight violet markings.

2) *Pale type*. — Less anthocyanine, producing slight violet markings on the wings, the standard being almost white and the corona colourless.

3) *White type*. — Complete absence of anthocyanine. The flower is white except for a pale greenish yellow shade round the base of the standard.

RESULTS OF CROSSES. — *Dark type* \times *pale type*. Many reciprocal crosses were made.

In the F_1 , the colour of the flower of the hybrid could not be distinguished in any way, from that of the dark-flowered parent. The dark type is, therefore, absolutely dominant over the pale type.

In the F_2 there was segregation in the Mendelian ratio of 3 dark flowers ; 1 pale flower.

In the F_3 , the pale-flowered plants of the F_2 gave, with very few exceptions, descendants which maintained this character constant. Among the descendants of the dark-flowered plants of the F_2 , however, this character remained constant in one third of the plants, and one third gave segregation in the ratio 3 dark-flowered plants : 1 pale-flowered plant.

To explain this phenomenon two genetic factors appear to be present. **L**, the factor of pale colouration, and **D**, the factor which increases the anthocyanine content without producing any visible effect except when in the presence of **L**. According to this hypothesis the combination of these two factors would give four homozygous types represented by the following formulae :

LLDD \times *dark flowers*.

LLdd \times *pale flowers*.

llDD \times *white flowers*.

lldd \times *white flowers*.

The dark and pale types, therefore, differ only in the presence or absence of the factor **D**. This explains the behaviour of the hybrids in the successive generations, namely :

F_1 , = **LLdD** or **LLDd**.

F_2 = $\frac{1}{4}$ **LLDD**, $\frac{1}{2}$ (**LLdD** + **LLDd**), $\frac{1}{4}$ **LLdd**.

Dark type \times *white type* = **LLdd** \times **llDD**. Only the F_1 of two crosses was studied which, in each case, was composed solely of dark flowered plants corresponding to the formula **LLdD**.

FORM AND EXTENT OF THE MARKINGS ON THE SPERMATOPHYTES. — From this point of view SPILLMAN divides the seed into two groups :

A) Solid colour ; the pigment covers the whole surface of the spermatophyte.

B) With more or less developed markings of four types :

- 1) Small eye ; a small spot round the hilum.
- 2) Holstein (the name of a variety showing this type) ; a large part of the surface is coloured, that which is not has two or three round spots.
- 3) Large eye ; the pigmented spot round the hilum is very large. This type is considered to be heterozygous between the Holstein and Small eye types.
- 4) Watson (name of a variety) ; the edge of the pigmented spot surrounding the hilum is indistinct towards the micropyle, where it ends in a point.

SPILLMAN (1) made a study of 21 hybrids including the small eye and solid colour varieties. In every case the F_1 was composed solely of plants with solid colour seeds. The F_2 , included the solid colour, Watson, Holstein, large eye, and small eye types in the ratio 9 : 9 : 1 : 2 : 1. Spillmann explains this by the existence of two factors transmitted independently of each other, namely a factor **W** for the Watson type, and a factor **H** for the Holstein type. The presence of both these factors would determine the appearance of the uniform colour ; their absence the formation of a single small spot of pigment. The types composing the F_2 have the following formulae :

- 1) Solid colour = $WWHH$.
- 2) Watson = $WWhh$.
- 3) Holstein = $wwHH$.
- 4) Small eye = $wwhh$.

The author made several crosses between the different types and obtained results similar to those of SPILLMAN, except that the large eye type was absent, being replaced by the large eye spotted type which also has a large eye but, in addition, small spots of pigment over the rest of the spermoderm. This type may be classified as Holstein. In genetic behaviour it resembles the true large eye type and may be considered heterozygous between small eye and Holstein.

The cross small eye (Black variety) solid colour (Rounceval variety) gave an F_1 composed solely of plants with a spermoderm of uniform colour, and an F_2 including an average of 365 solid colour plants + 68 of the Watson type + 119 of the Holstein type + 27 of the small eye type. The numbers of the plants corresponding to the ratio of di-hybridism 9 : 3 : 3 : 1 should be 326 : 109 : 109 : 36 respectively. The true number of plants having the Holstein factor (solid colour and Holstein types) was, therefore, much greater than the calculated number. This would make SPILLMAN's theory of two factors inapplicable to this cross.

The behaviour of the F_3 , was as follows :

- 1) The solid colour type behaved in four different ways : — a) it remained constant ; b) it broke up into plants of the solid colour (**H**) type

(1) SPILLMAN, W. J., Inheritance of the "Eye" in *Vigna*, in *The American Naturalist*, Vol. 45, No. 537, pp. 513-523; 1911. See also Colour Correlation in the Cowpea, by the same author in *Science*, No. 974, p. 302, 1913.

and the Watson (**h**) type in the ratio $H : h = 4.8 : 1$, differing from the theoretical ratio $3 : 1$ of SPILLMAN; c) it broke up into solid colour (**W**) and Holstein (**w**) plants in the ratio $W : w = 3.1 : 1$; d) it broke up into plants of the solid colour, Watson, Holstein, and small eye types in the ratios $H : h = 7.2 : 1$, and $W : w = 2.6 : 1$.

2) The Watson type broke up into the Watson and small eye types in the ratio $W : w = 2.6 : 1$.

3) The Holstein type broke up into the Holstein and small eye types in the ratio $H : h = 4.7 : 1$, or else remained constant.

4) The small eye type remained constant.

These results show that in both the F_1 and the F_2 , the ration $H : h$ differs appreciably from the theoretical ratio $3 : 1$.

According to SPILLMAN's theory the following geno-types should appear in the F_2 :

Homozygous			Heterozygous		
WWHH	Solid colour	(S)	wwhH	Holstein	breaking up into $3 H : 1 Se$
WWhh	Watson	(W)	wWhh	Watson	" " $3 W : 1 Se$
wwHH	Holstein	(H)	wWhH	Solid colour	" " $9 S : 3 W : 3 H : 1 Se$
wwhh	Small eye	(Se)	WWHH	Solid colour	" " $3 S : 1 W$
All remaining constant			WWhh	Solid colour	" " $3 S : 1 H$

According to the above scheme the heterozygous types with solid colour seed should produce a certain number of families including plants of the solid colour type and others of the Watson type, and an equal number of families including both the solid colour and the Holstein types. On the contrary, however, there is a marked numerical predominance (three times greater) of the mixed families with the Holstein type.

According to the author this is due to the presence of two factors H_1 and H_2 , both capable of producing the Holstein type, so that the gametic formula of the type with solid colour seed would be $WWH_1H_1H_2H_2$. The cross $WWH_1H_1H_2H_2 \times wwh_1h_1h_2h_2$ should give in the F_2 27 $WWH_1H_1H_2H_2$ (solid colour) + 9 $WWH_1h_1h_2h_2$ (solid colour) + 9 WwH_1H_2 (solid colour) + 9 wH_1H_2 (Holstein) + 3 WwH_1h_2 (Watson) + 3 wH_1H_2 (Holstein) + 3 WwH_2 (Holstein) + 1 wwh_2 (small eye). The ration between the four types should be $45 S : 3 W : 15 H : 1 Se$. Of the 45 S, 7 remained constant, 14 broke up into S and H, 8 into S and W, and the 16 remaining into four types. This would account for the numerical predominance of Holstein.

The presence of two Holstein factors capable of producing the same effect when acting in conjunction or separately is a case similar to that of the cereal grain possessing two or more independent factors for the same colour, such as the black oats studied by NILSSON-EHLE in 1908, and the red wheat described by Howard in 1912.

COLOUR OF THE SPERMODERM. — The most important results obtained were :

- 1) The black colour of the spermoderm is due to a single factor **B**, the presence of which is dominant over its absence.
- 2) In the crosses between brown and red types two factors are involved — **N** which produces the brown colour and is dominant to **M** which produces a chestnut colour. In the absence of both **N** and **M** the spermoderm is red. These two factors are transmitted independently of each other.

Relation between the colour of the flowers and the spermoderm. — Crosses between solid colour and small eye types have shown the presence of a genetic correlation between the colour of the flowers and that of the spermoderm. Thus, the flowers of plants having the Watson factor were always dark, whereas Holstein and small eye plants, in which this factor is absent, had pale flowers. It may be concluded that the dark colour of the flowers and the spots on the spermoderm of the Watson type are due to a single factor.

GENERAL LIST OF THE FACTORS PRODUCING THE COLOUR OF FLOWERS, THE DESIGN AND COLOUR OF THE SPERMODERM :

L produces the colour of the pale flowers and its action is seen only in the types with a Holstein or small eye spermoderm.

D only shows its action in the presence of **L** when it makes the colour of the flowers dark and changes the small eye markings to Watson markings, and the Holstein marking, to solid colour.

H₁ changes the small eye markings to Holstein markings.

H₂ has the same effect as **H₁**.

B produces the black colour of the spermoderm.

N produces the brown colour of the spermoderm.

M produces the chestnut colour of the spermoderm.

The factors forming the following pairs appear in each case to be transmitted independently of each other : — **L** and **D**, **D** and **H₁**, **D** and **H₂**, **H₁** and **H₂**, **M** and **N**.

716 — **Improvement in Strawberries in America by Hybridisation and Selection ; New Types of Strawberries with Continued Production.** — VAN FLEET, W. in the *Journal of Heredity*, Vol X, No. 1, pp 12-16 + 2 Figs. Washington, January, 1919.

Varieties of strawberries which, under favourable weather conditions, continue to bear fruit throughout the summer and autumn after having given a good yield in spring are more and more appreciated by growers. These types which produce continuously have the stolons very slightly developed and an abundant formation of tufts of fertile branches. They are all derived from Pan American, which originally was a mutation from the Bismark, an old commercial variety of *Fragaria Virginiana*.

Among the new types the first place is held by Progressive and Superb, which are rapidly propagated by seed and subjected to suitable crosses with European Alpine varieties of *Fragaria vesca* with the object of adding valuable new characters. *Fragaria vesca* (both the European and

Mexican types) cannot flourish in North America because of the excessively hot summer, and the fruit, although fragrant, is small and not very firm.

In 1914 Prof. W. F. WIGHT, of the U. S. Bureau of Plant Industry, who had been sent out to Chile as Agricultural Explorer, sent the Bureau seeds of a strawberry of the Alpine type (*Fragaria vesca*) bought on the market of Santiago. He was unable to discover their exact origin. These seeds were sown in the Experimental Acclimatation Gardens of Rockville, Md., and Chico, Cal. and plants were obtained of vigorous growth, high productivity, and a capacity of adapting themselves to the climatic conditions of the United States superior to that of any other variety of *Fragaria* hitherto studied. The characteristics of the new strawberry (No. 35 005) obtained are :

- 1) Resistance to the hot, dry summers of North America.
- 2) Continuous production from June till the first autumn frosts.
- 3) The fruit is fine and large, but not very firm and, in this respect, inferior to the fruit of *Fragaria Virginiana*.
- 4) Abundant formation of sterile branches accompanied by an abundant production of stolons. In this respect the new Chilean variety is distinctly superior to the *Virginiana* types with continuous production and floral ramifications but a low stolon production.

In order to combine the positive characters of the South American variety with those of the *Fragaria Virginiana* variety, a series of crosses were started in February, 1916, on the Bell Experiment Plot at Glendale, Md., between the South American type and the two varieties Early Jersey Giant and Chesapeake. The hybrids thus obtained the characters of the parents in good proportions :—

- 1) Uninterrupted production from July till November ;
- 2) in addition to the very copious formation of fertile branches there is an abundant formation of stolons ;
- 3) the fruit is fine, large, and compact.

Attempts are also being made to fix and propagate a new type which would satisfactorily replace the Pan American variety, which, as has been said, has the disadvantage of too slight a formation of stolons.

717 - **Strawberry Hybrids Resistant to Cold in Alaska** (1). — GEORGESON C. C., in the *Report of the Alaska Experiment Station*, 1917, p. 27 + 1 fig. Washington, 1919.

The strawberry hybrids Nos. 320 and 275 obtained at the Sitka Experiment Station (coastal district) proved capable of resisting and flourishing at Rampart, in the Yukon Valley, without any further protection than that offered by the snow. It should also be noted that the fruit is of better quality, sweeter and firmer at Rampart than at Sitka. This is perhaps because in the interior the summer is warmer and drier.

(1) On the hybridisation of strawberries in Alaska, see R. June, 1918, No. 632. (Ed.)

718 - Isolated Case of Mutation in a Sweet Pea Hybrid, in England. — PUNNETT R. C., in the *Journal of Genetics*, Vol. VIII, No. 1, pp. 27-31 + 1 Fig. London, December, 1918.

In 1903 a cross was made between the two white-flowered varieties of the sweet pea (*Lathyrus odoratus*) Blanche Burpee (with elongated pollen grains) and Emily Henderson (with spheroid pollen grains). The flowers were normal in the hybrids, not only of the F_1 generation, but also in the F_2 and F_3 .

From the F_3 family of No. 304 were selected 14 plants and the seed sown. This gave an F_4 composed of 1118 plants. All these were normal except one, the flowers of which were completely abnormal in character, showing characters of a mutation already previously described by the author and M. BATESON (*Journal of Genetics*, Vol. I, 1911), i. e. : — 1) long, narrow stigmata projecting far beyond the corona ; 2) standard and wings smaller than in normal flowers ; 3) sterile female organs.

The mutating plant was derived from a single seed of the F_3 plant No. 304⁶/1906 and was unique in a family composed of 52 plants. It is unlikely that this mutation was produced by the fusion of two gametes with disappearance of the factor determining the normal structure of the flower, because this fusion should already have occurred in the parent plant No. 304⁶ of the F_3 , that is to say, in the plant No. 309⁷ of the F_2 . In this case there should have been not one single mutant but, in accordance with BARRIET's theory of mass mutation (1) a number of mutations representing about 25 % of the total number of plants of the family in which the mutation occurred. Moreover there should have been further cases of similar mutations in the successive generations to the F_6 . This did not, however, occur.

For these reasons the author believes the isolated case of mutation described to be caused by a change taking place in the plant at some stage following fertilisation. As a result of this change the factor determining the normal structure of the plant is either lost or modified during the process of the somatic division of the cells.

719 - On Hybridisation of Some Species of *Salix*, in Japan. — IKENO, S., in the *Journal of Genetics*, Vol. VIII, No. 1, pp. 37-58 + 1 Fig + 1 Plate London, December, 1918.

The author crossed different species of willow (*Salix purpurea* var. *multinervis*, *S. gracilistyla*, etc.) with the object of determining, 1) whether there is any segregation of the characters ; 2) whether such segregation, if it occurs, is in accordance with the Mendelian laws.

METHOD. — Branches with male inflorescences were cut a few days before the flowers open and the lower end kept in a jug of water. As soon as the flowers opened the pollen was removed from the stamens with a brush and placed in a Petri dish.

The branches with female flowers were isolated by means of paper bags two or three days before the flowers opened. At a suitable time a brush covered with pollen was passed over the stigmas of each flower in turn. If fertilisation takes place the stigma fades two or three days after pollinisation

(1) See R. April, 1919, No. 446. (Ed.)

and the ovary begins to swell. If fertilisation does not take place the stigma remains firm for several days, until the whole inflorescence becomes detached from the branch.

CROSSING EXPERIMENTS. — Of the crosses made by the author in the Botanical Garden of Komaba, near Tokyo, the most interesting was that of *Salix purpurea* var. *multinervis* × *S. gracilistyla* made in 1910.

CHARACTERS OF THE PARENT *Salix purpurea* var. *multinervis*: Erect stem and branches; glabrous leaves without stipula; catkins not very hairy; scarlet stigma.

CHARACTERS OF THE PARENT *Salix gracilistyla*: — Spreading branches, leaves hairy on the under surface, especially along the veins, catkins covered with long, close, grey hairs, green stigma.

CHARACTERS OF THE HYBRIDS: — In the F_1 : — Spreading branches; glabrous leaves, some with, some without stipules; catkins covered with hairs that are usually abundant but sometimes scarce; scarlet stigma. Taken as a whole the characters are intermediate, but there are some phenomena of dominance. Individually they behave as follows:

1) *Manner of growth of the plant.* — During the first stages of growth the F_1 hybrids behave like *S. gracilistyla*. The trunk ramifies almost at the base and the branches are horizontal. Spreading growth is, therefore, dominant to erect growth. Later the plant may produce erect branches of the *S. p. multinervis* type, thus assuming an appearance intermediate to those of the two parents.

In the F_2 , out of 442 plants, 224 were spreading in growth and 218 erect. This shows there to be segregation of characters, but not conforming to the Mendelian laws.

2) *Hairiness of the leaves.* — During the first stages of development the leaves of the F_1 hybrids were completely glabrous, so that absence of hairs may be considered a character dominant to hairiness.

Of 425 plants of the F_2 , 351 had completely glabrous leaves and 74 more or less hairy leaves. Here also, then, there is segregation of dominant and recessive characters, but in a ratio differing widely from that of Mendel.

3) *Stipules.* — The F_2 hybrids form a sort of mosaic with respect to the two parents. On the same plant, sometimes even on the same branch, there were both leaves without stipules and leaves with fairly well developed stipules.

In the F_2 , of 232 plants, 170 were intermediate in type and 62 without stipules. Nevertheless, the author believes that the stipules may form at a more advanced stage of the plant's development and, for the moment he is of opinion that segregation of the two characters should not be definitely admitted.

4) *Colour of the stigma.* — In the F_1 the stigma was scarlet, this colour being dominant to green.

Distinct segregation took place in the F_2 ; there were 115 plants with a scarlet stigma, 16 with a green one, and 7 with a greenish-red one. If all the plants with scarlet or greenish red stigmas are placed in one group (red) there are 122 plants with red stigmas and 16 with green ones. The ratio between them will be 8 : 1, a totally different one from the Mendelian ratio

5) *Character of the catkins.* — In the F_1 there were two distinct types — type G (*gracilistyla*) with catkins covered with close hairs, and type M (*multinervis*) with catkins having little hair.

In addition to the two types G and M there was, in the F_2 , a new, completely glabrous type.

To explain these phenomena the author made three series of crosses:— 1) G ♀ × G ♂; 2) M ♀ × G ♂; 3) M F_1 ♀ × M F_2 ♂. The following table gives the results obtained and shows the number of plants of each type in the F_2 of each of the crosses respectively.

Cross	Number of plants in the F_2		
	Type G	Type M + new type	Total
1) G ♀ × G ♂	187	32	219
2) M ♀ × G ♂	77	82	159
3) M F_1 ♀ × M F_2 ♂	3	15	18
Totals	267 = 64,4 %	129 = 32,6 %	396

In case 1, which may be considered as corresponding to self-fertilisation of the F_1 plant with hermaphrodite flowers, there are, in the F_2 , many descendants of the G type, and few of the M type.

Just the opposite occurs in case 3.

In the F_2 of case 2 both types are present in almost equal numbers.

These three crosses show that each of the F_1 plants, whether of the G type or the M type, is heterozygous, and produces when fertilised in a manner corresponding to self-fertilisation of the hermaphrodite flowers, not only descendants reproducing its own type, but also a small number of descendants of another type. There is, therefore, distinct segregation of characters, but not in accordance with the Mendelian ratios.

CONCLUSIONS. — As a result of the crosses carried out by WICHURA in 1865 it was generally admitted that willow hybrids were stable and transmitted their characters integrally to their descendants. The author's experiments, however, seem to show the contrary to be true, at least with respect to certain characters. For example, spreading growth is dominant to erect growth, on the leaves pubescence or absence of hairs may be dominant or recessive according to the species, and scarlet stigma is dominant to green stigma. All these characters undergo segregation in the F_2 .

The F_1 hybrids between species with stipules and species without stipules, however, show a sort of mosaic, some of the leaves having stipules, and some having none, and so far it has not been possible to prove any segregation of these characters in the F_2 .

With the exception of this case the author was able to prove segregation of the other allelomorphic characters. This segregation, however, occurs in ratios very different from the usual Mendelian ones 3 : 1, 15 : 1, 63 : 1, etc.

It is, therefore, probable that each character depends on a large number of factors which complicate segregation in the F_2 . This segregation may also obey laws different from the Mendelian ones and hitherto unknown.

720 - **The Electro-Chemical Treatment of Seeds.** — I. DUNN, II H., The Electrification of Seeds, in *The Journal of the Land Agents' Society*, Vol XVII, No 12, pp 460-462. London, December, 1918. — II IDEM, Idem, in *The Electrical Review*, Vol LXXXIV, pp. 89-90. London, 1919. — III *The Times*, passim.

AGRICULTURAL
SEEDS

Agricultural journals and other publications have lately frequently discussed WOLFRYN's electro-chemical process for the treatment of seeds. By this method the seeds are soaked in the chemical solution of a salt (sodium nitrate, ammonium sulphate, etc.) which is then subjected to a low electric current (0.5 - 1.25 amperes; 200 volts) during a period varying from 3.5 to 6 hours, according to whether wheat, barley, or oats are being treated.

The nature of the salt in solution the density of the solution, temperature, intensity of the current, arrangement of the electrodes, duration of immersion and passage of the current, have not yet been determined exactly with relation to the kind of seed treated. The effect of the ions (produced by electrolysis of the salt solution) on the germinating capacity of the different seeds, the conditions necessary to favour the penetration of these ions through the tissues of the seeds, and the extent to which the beneficial effects are due to the action of the current itself rather than to ionisation, all remain to be studied. Some of the various patents taken out recommend the use of radio-active solutions, others the exposure of the seeds to ultra-violet rays.

The drying of the seeds is very important and presents both practical and technical difficulties. It demands a rather low, uniform temperature throughout the drying room and, to be commercially profitable, it must be possible to treat large quantities of grain simultaneously. Up to the present the best results have been obtained in malt kilns, but a mechanical process is being studied which does not require skilled workmen, and, at the same time, assures a uniform and constant production. Seed treated electro-chemically germinates more rapidly and gives a better and higher yield.

Henceforth all investigations should especially aim at determining the specific treatment to be applied to every variety of seed with respect to the solution used, etc. The fundamental question to be solved is that of making electrification practical, economical, and commercially profitable. When the newness of these experiments is considered good progress seems to have been made in this direction. The first installations for this treatment only date from the beginning of 1918. The largest is at Poole, Dorset. Over two thousand acres were sown with electrified seed. At the end of July and beginning of August the experimental plots were visited by three delegations including representatives of the following governments:—United States India, Australia, Brazil and Japan, as well as most of the best known agriculturists and representatives of the London daily press.

According to the results registered by a witness who was neither a farmer nor interested in any patent, the increase in yields obtained from the crops at Poole were (in bushels):—

Wheat 6.74, 12.33 ; oats 5.73, 18.49, 20.06, barley 16.87.

Farmers reported the following increases :

Wheat 5.90, 6.76, 7.72, 8.75, oats, 5.14, 6.67 ; barley 1.11.

Other farmers estimate the increase in grain yield to be approximately 50 % and the yield in straw to be increased also.

Good results have also been obtained with potatoes, maize, tomatoes, and other plants. In the United Kingdom there are no fewer than 25 establishments for the electro-chemical treatment of grain either finished or in course of construction.

721 - **Relation of Varying Degrees of Heat to the Vitality of Seeds.** — BURGESS, J. L., in the *Journal of the American Society of Agronomy*, Vol. XI, No. 3, pp 118-120 + 1 Table Lancaster, Pa., March, 1919

In order to determine the extent to which treating seed by heat for the destruction of insects may influence their vitality the authors made a series of experiments at the North Carolina Seed Laboratory. Wheat, oats, rye, maize, soybeans, cowpeas, etc., were subjected to different degrees of heat during various periods. As a rule, the higher the temperature, the shorter was the time the seed was subjected to it.

RESULTS. — *Cowpea* seeds were the most sensitive to heat. They were generally killed when exposed to a temperature of 90° C for a period of 5 hours, but their germinating capacity did not appear to be affected when they were subjected to a temperature of 60° C for 1 hour.

The germinating capacity of *soybeans* was hardly affected by a treatment at 60 to 90° C during 1, 3, or 5 hours.

When *maize* was subjected to a temperature of 80° C during 1 hour its germinating capacity was reduced to 68 % ; the same treatment during 3 hours reduced it to 32 %. The germinating capacity of the control seed was 94 %.

The germinating capacity of *oats* did not seem to be affected by different treatments varying from 60° to 90° C during 1, 3 or 5 hours. In this case, however, there appears to have been an experimental error as the germinating capacity of the control seed was shown to be lower than that of the treated seed.

Subjecting *rye* to a temperature of 80° to 100° C during 5 hours had practically no effect on its germinating capacity, but a treatment at 110° during 2 hours reduced this capacity to 78 %, and a treatment at 120° during 5 hours killed the grain.

High temperatures seriously affected the germinating capacity of *wheat*. Treatment at 110° for 1 hour reduced it to 60 % and when prolonged during 3 hours, to 55 %. A temperature of 120° during 1 hour killed the grain. The germinating capacity of the control seed was 92 %.

CONCLUSIONS — Soybeans, rye and oats may safely be subjected to high temperatures to destroy insects. According to some workers (DEAN, etc.) the lowest temperature used in these experiments is sufficient to destroy insects. It has, however, not yet been determined whether this temperature is high enough to destroy the eggs of the insects.

- 722 - **The Effect of Certain Organic Substances on Seed Germination.** — FRED, E. B., in *Soil Science*, Vol. VI, No. 5, pp. 333-342 + 8 Tables + 4 Plates + Bibliography of 27 Publications. Baltimore, November, 1918.

Previous experiments have shown that green manure is unfavourable to the germination of certain seeds (1), the injurious factor being attributable to certain soil fungi. A continuation of these investigations gave further data on the effect of different organic compounds on germination. The results obtained showed that alfalfa powder, casein, and peptone, have little or no effect on the germination of different types of seed except when used in large quantities. There is, therefore, no relation between the injurious effect of green manures and their nitrogen content. The reduced germination due to the application of excessive quantities of casein or alfalfa powder is not further reduced by applying calcium carbonate.

Sugar delays germination and, at the same time, favours bacterial development and also reduces the germination percentage. The retarding action of sugar on the germination of seeds is due to the large amount of carbon dioxide formed during the decomposition of the sugar.

Sterilisation of the soil inhibits the germination of seeds to a considerable extent.

- 723 - **Comparative Cultural Tests with Different Varieties of Winter Wheat at Tornby, Sweden.** — WÄLSTEDT, I., in the *Sveriges Utsädesförenings Tidskrift*, Year XXIX, Pt. 1, pp. 13-27. Malmö, 1919.

CEREAL
AND
PULSE CROPS

Results of a series of comparative cultural trials made from 1914 to 1918 at the Station of Tornby (auxiliary to Svalöf for Östergötland) with a view to establishing what type of wheat is best adapted to the region.

Average yield in quintals per hectare — Sol II, 4235; Pansar, 3980; Thule II, 3970; Sol I, 3940; Iduna, 3905; Extra Squarehead 3785; Bore, 3620.

Considering the yield of Sol I as equal to 100, we have, as index of relative productivity, the following figures: Sol II, 107.2; Pansar, 101.0; Thule II, 100.8; Sol I 100.0; Iduna, 99.1; Extra Squarehead 96.1; Bore, 91.9.

The results obtained confirm the absolute superiority of Sol II as the type best adapted to Östergötland; Pansar, the best type for the southern districts, loses its superiority because of its late maturity, and Thule, the variety most adapted to the districts of the north of Svealand, though giving a high yield, is none the less inferior to Sol II.

- 724 - **Cultural Trials of Different Varieties of Wheat, Barley and Oats in Seeland, Denmark.** — JACOBSEN, A. P., in the *Beretning om Landboforeningers Virksomhed for Plantearbejdet paa Sjælland 1918*, pp. 529-533. Copenhagen, 1919.

WHEAT. — At Borandhøfgaard (Isle of Möen) the following yields of wheat per hectare have been obtained: Dronning Wilhelmina II,

(1) See R. July, 1916, No. 734. (Ed.)

4 200 kg. ; Smaahvede II, 3 733 kg. ; Rodhvede (= red wheat), 3 722 kg. ; Tystofte Standvhede II, 3 000 kg.

At Roskilde (a locality situated at the extremity of the fjord of the same name, on the northern coast of Seeland) the wheat Smaahvede II surpassed even Pansar of Svalöf, for it produced 3 200 kg. of grain per hectare, as compared with 2 868 kg. for the latter.

At Kallundborg (western coast of Seeland) Tystofte Smaahvede (3 600 kg. per hectare) surpassed Dronning Wilhelmina (3 400 kg.)

On the general average Tystofte Smaahvede II occupies the first place ; it is also, as a matter of fact, the favourite and most wide-spread variety in Seeland. In very fertile soil, where winter conditions are not too unfavourable, Dronning Wilhelmina may give excellent results.

BARLEY - Among the 2-rowed varieties, Tystofte Prentice takes the first place : it produced (average of 6 trials) 233 kg. of grain and 520 kg. of straw more than the Svalöf Gullkorn variety (yellow barley of Svalöf). It surpassed also in yield Abed Juli and Tystofte Korsby (6-rowed barleys).

OATS. — Sorts studied : — Svalöf Seger, Svalöf Kron, Tystofte Stjern, Tysk Gulhavre (German yellow oats) Svalöf Guldregn. The Svalöf Seger gave the best results.

725 - Cultural Trials of Different Varieties of Two-Rowed Barley, in Denmark. —

KARSTEN, in the *Tidsskrift for Planteavl*, Vol. XXVI, Pt. I, pp. 1-36 + 16 Tables. Copenhagen, 1919.

Numerous cultural trials have assigned to the Archer (Prentice) variety the leading place from the point of view of grain yield. The different varieties sprung from Prentice, that is to say Svalöf's Princess, Lyngby Prentice, Tystofte Prentice and Abed Prentice, do not differ from one another morphologically.

The cultural trials, aimed at comparing the qualities of Tystofte Prentice (which may be considered as a representative type of the varieties sprung from Prentice) with those of six new sorts of 2-rowed barley created at Svalöf and Abed : that is to say : (a) Abed Binder, Svalöf Golden and Svalöf Hannchen, with early maturity and strong straw : (b) Tystofte No. 40, Abed Rex and Abed No. 570. These cultural trials were made during the four years 1913-1916, in seven localities differing in climate and soil.

The average yields (in quintals per hectare) were for grain and straw respectively : — Tystofte Prentice, 29.7 and 42.6 ; Tystofte No. 40, 27.3 and 41.5 ; Abed Rex, 29.7 and 41.6 ; Abed No. 570 : 28 and 40.1 ; Abed Binder, 29.6 and 37.8 ; Svalöf Golden, 29.0 and 38 ; Svalöf Hannchen, 27.8 and 37.8

The tendency to lodge, expressed in relative values ranging from 1 (= standing straw) to 10 (lodged straw) was as follows : Tystofte Prentice, 5.6 ; Tystofte No. 40, 3.2 ; Abed Rex, 3.6 ; Abed No. 570, 4.5 ; Abed Binder, 2.0 ; Svalöf Golden, 2.3 ; Svalöf Hannchen, 2.9

On comparing these figures with those of the yields it is seen that

the yield of each of the varieties tested is in strict agreement with their respective degree of tendency to lodge.

726 - Improved Soy Beans for Cultivation in Manchuria. — *Commerce Reports*, No. 61 p 1242 Washington D C., March, 13 1919

The South Manchuria Railway Company's Agricultural Experiment Station succeeded in improving soy beans a few years ago, and distributed 30 to 40 koku (154 to 205 bushels) of the improved beans throughout Manchuria, and the new variety is now very favourably received. In 1918 at Szuping kai 400 koku (2 048 bushels) were harvested and shipped to Kobe where they were so well received that orders for next year's crop are coming in. The improved variety has the advantage of containing more oil and being uniform in shape and size, and possesses a very fine lustre. This variety yields a 15 to 20 per cent greater crop from the same area of land and fetches 20 sen (10 cents) more per koku than other varieties. Naturally there is now an increasing demand for the seeds of the new bean, which the Experiment station is unable to supply. Some newspapers point out that the new variety is a strong rival to the Chosen or Hokkaido beans, but the Manchurian beans are produced for obtaining oil, and the new variety is specially fitted for that purpose, while the Chosen or Hokkaido beans are used for food.

727 - Flour from the Seeds and Starch from the Roots of *Icacina senegalensis*. — CERIGHELLI, R. in the *Annales du Musée Colonial de Marseille*, Year XXVII, third Series, Vol. VII, Pt. 1, pp. 109-178 + 2 Plg Paris-Marseilles, 1910.

STARCH CROPS

Icacina senegalensis A. Jussel, is a tuber-bearing plant which, first recorded in Senegambia, has been recorded more recently by M. AUG CHEVALIER (1) in abundance in the Chari region. According to M. CHEVALIER it is a weed of cultivated crops, of no great value, but children eat the fruit. From information recently supplied to the author by M. BAUDON, colonial administrator, it appears that this statement is not altogether exact; if the plant is often a harmful weed, it is, on the other hand, often used by the natives as food. In times of scarcity, when there is a shortage of sorghum, the blacks eat either the flour from the seed or, less usually, the starch from the tubers.

	Flour	Starch
Moisture	12.65	12.90
Nitrogenous matter.	7.80	—
Fats.	0.08	traces
Starch, sugar	72.36	84.96
Fibre	3.90	traces
Ash	0.48	0.26
Undetermined and losses	2.73	1.88
	100.00	100.00

(1) A. CHEVALIER: *L'Afrique centrale française (Chari-Lac-Tchad Mission)*, 1908, p 51. (Auth)

As this flour and starch are little known, the author has studied them chemically and microscopically. He describes the plant from a botanical standpoint and gives the native method of preparing the flour and starch; the results of the chemical analysis are given below.

FIBRE CROPS 728 - Development of Cotton Cultivation in Corea — *The Board of Trade Journal*, Vol. CII, No. 1166, p. 432, London 1919.

The first stage in the Government-General's programme for the encouragement of cotton growing in Corea, which aimed at the extension of the area under cultivation to 245 000 acres (subsequently reduced to 208 000 acres, when it was found that Saishu Island, south of Corea, was unsuitable), having been brought to a successful conclusion, the second part of the scheme, which aims at a still further expansion, is now being begun.

In 1918 the area under cultivation reached nearly 200 000 acres, and the crop of new cotton amounted to slightly over 100 000 000 lb, which realised the amount estimated. But this amount being only a small fraction of Japan's demand, need for further extension of cotton cultivation is felt. It is desired to make Corea the main source of Japan's supply of cotton, and thereby to enable her spinning and weaving industries to be independent of foreign supplies.

The six Provinces of North and South Zenra, North and South Keisho, North and South Chusef, are considered suitable for American cotton, and the four Provinces of Keikido, Kokaido, North and South Heian-do for native cotton. By the end of 1928 it is planned to have under cultivation an area of some 250 000 acres planted with American cotton, and 85 000 acres with native cotton; total 335 000 acres. The possible cultivable area, it is stated, should eventually reach 625 000 acres if the methods of cultivation are improved, and an annual production of 333 000 000 lb. of raw cotton is aimed at.

The following table shows the estimated annual production of cotton in Corea at the end of the second period of encouragement of cotton growing (1928):—

	RAW lb.	GINNED lb.
American cotton	265 000 000	87 000 000
Native cotton	68 000 000	20 000 000
Total	333 000 000	107 000 000

729 - *Crotalaria usaramoensis* as a Textile Fibre Plant; Researches in the Dutch East Indies. — BLUY, G. F. J., in the *Mededeelingen uit den Cultuurtuin*, Nos 12-13, p 6 + 1 Fig. + Table + Specimen Buitenzorg, 1918.

Publication of the Department of Agriculture, Industry and Commerce of the Dutch East Indies.

The author gives the results of his researches, carried out in the Cultural Experiment Garden at Buitenzorg, on a plant valuable for its textile fibre, *Crotalaria usaramoensis* Bak. The seeds were obtained from the Biological Institute of Amani (German East Africa). The plant is easy to

grow, but, when it is being grown for the first time it is advisable to inoculate the soil with nitrifying bacteria. Plants for the production of seed should be planted 19 in. \times 19 in. apart; if only fibre is required, they can be planted closer together. As Buitenzorg has a very rainy climate, it has not yet been found how many months of drought the plant can stand, nor what is the quality of the fibre under these conditions; the best time for sowing appears to be at the end of the rainy season. This plant should be grown in rotation with other crops, as it should not be grown for two successive years on the same soil. The plant seems very free from fungoid disease; the damp climate, however, seems to favour attack by *Sclerotium Rolfsii* and a fungus probably *Corticium salmonicolor*, is often observed on old plants.

The first harvest is gathered 5 or 6 years after sowing. The plants are cut through 3 or 4 inches above the soil and the leaves are removed by hand; the leaves form an excellent green manure (1) or a good cattle food; the animals must get accustomed to it and it should be given in gradually increasing amounts. Analysis shows that the leaves and seeds of *C. usaramoensis* are free from the toxic alkaloid contained in the seeds and leaves of *C. striata*. The yield of leaves has reached 7000 to 8500 kg. per hectare. An analysis of the dry leaves made by de JONG gave the following results:— Nitrogen, 4.27 %; albuminoids, 26.7 %; Fat, 7.0 %; Starch, 9.6 %; Crude fibre, 20.1 %; Ash, 4.5 %. The leaves used as green manure provide the soil with nearly 70 kg. of nitrogen per hectare in 5 months. The yield in stems stripped of leaves (tied in sheaves) varies, according to the nature of the soil and the distance between the plants, from 8000 to 25000 kg. per hectare.

The fibre of *Crotalaria* is cortical, and the stems require retting like flax and hemp; this operation, awkward in Europe, becomes difficult in a tropical climate. Again the fibre is very sensitive to a retting that is too long or too short; in the first case it loses much of its resistance to an extension strain. The duration of retting depends on the nature of the stem (young or old, thin or thick, etc.), and on the kind and temperature of the water. The author has carried out several retting experiments: by exposure to damp air ("dauwrotting"), in a stream, etc.; under these conditions, the fibre obtained is too dark. The best results were obtained by retting in a ditch where the water was continually renewed by a jet of spring water; under these conditions, the fibre was sufficiently detached in 5 or 6 days. The stems stripped of leaves gave an average yield of 2 % of dry fibre. The elasticity of the fibre is from 1 to 2 %, its resistance to extension, expressed in the number of kilometres theoretically necessary to break the fibre purely by its own weight, is 16 to 17 km. on an average.

It will be seen that the yield of fibre per cent is somewhat low (but there is no reason to suppose that were the plant grown in another climate it would not give a better yield) nor can the fibre compete, as regards quality, with that of the chief textile plants already in use. But this

(1) As regards this point, see R., October 1917, No. 903. (Ed.)

plant has the advantage of being useful for other purposes, as has already been shown (green manure, cattle food), and the root could probably be used for making paper pulp; the woody matter left after retting makes an excellent fuel and the seeds might be used as a poultry food. The seeds contain: — Water, 12.9 %; Oil, 2.98 %; Albumin, 23.25 % (nitrogen, 3.72 %.)

It has also been found that in the district where *Crotalaria* is cultivated, bees produce excellent honey.

**PLANTS
YIELDING OILS,
DYES,
ANNINS, ETC.**

730 - *Elaeis Poissonii* (1) in the Belgian Congo. — FATHER GILLET, in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXVII, No. 5, p. 150, Paris, May, 1919.

The palm known at Mayomba (and which exists at the State Post at Cauda-Sundi) under the native name of "Voa-Kania" is none other than *Elaeis Poissonii* var. *tenera* E. Annet. The other variety of this palm, the variety *dura*, exists in the Kisantu district; there it is uncommon and known by the native name of "Sampatu" (i. e., shod).

The author asks if the variety from Mayomba and that from Kisantu really constitute two different varieties, seeing that both kinds of fruit (*tenera* and *dura*) occur on the "Sanipatu" palm. He is of the opinion that that variety is not yet fixed and that some specimens have been hybridised. The only way to settle the question is to study it at length on the spot.

**RUBBER,
GUM AND RESIN
PLANTS**

731 - Rubber from Hainan, China. — See No. 680 of this Review.

732 - Tabanuco Gum or Porto Rico Elemi. — *Scientific American Supplement*, Vol. LXXXVII, No. 2256, p. 201 New York, March 29, 1919.

Elemi is the trade name of a fragrant gum-resin obtained from a number of trees chiefly of the myrrh family of plants (2). The plant yielding the Porto Rico Elemi is known botanically as *Dacryodes hexandra* (3) and is locally called «tabanuco». While the tree occurs on a number of the islands of the Lesser Antilles, it appears to find its best development in the hills at the eastern end of Porto Rico. It produces the best timber on the island and is at the same time the commonest tree, reaching as much as five feet in diameter and attaining a height of 50 feet to the first branch.

The bark is very clean and smooth containing an immense amount of gum for which there appears to be no particular use except locally for torches. When the bark is cut through with a "machete" an enormous quantity of so-called gum exudes and runs down the trunk. This is true not only of trees standing in the forests, but also of trunks that have been felled for some days. If the bark is still green and has not been affected by long exposure to the sun, wind and rain, the gum will begin to flow freely when the bark is hacked.

The gum is collected and used locally for incense and for torches, and for this reason the tree is often called candlewood. The method of tapping

(1) As regards the creation of the species *E. Poissonii* and its two varieties *tenera* and *dura*, see R., September 1918, No. 986. (Ed.)

(2) *Canarium* spp. Of the family of *Burseraceae* (Asia, Africa, America). (Ed.)

(3) *D. h. Griseb*, also of the *Burseraceae* (Ed.)

is the same as that used for gathering the gum from rubber trees, which consists of hacking two slanting cuts forming a V. shaped wound in the bark. The gum runs down the trunks and, when it is to be used for torches, is collected into masses on a central stick and held in place by wrappers formed by the leaf sheaths of the Royal palm. The volatile oil gradually evaporates, leaving a solid resinous mass and forming an excellent candle used extensively by the natives.

When the gum is desired for incense or for other purposes, greater care is taken in collecting it. It is generally put up in a semi-fluid state of a yellowish color depending upon the grade or purity of the gum. Its chief use in the region of its growth is as a stimulant ointment for indolent ulcers, but the regular medical practitioners seldom prescribe it. It is generally found aboard sailing ships in tropical America.

The gum is more largely employed in the arts and it is believed that after it becomes better known in this country a good use can be made of it in the manufacture of varnishes, soaps, felting, and especially in the making of printers' ink for which its honey-like consistence and adhesive character are peculiarly useful. However, a series of experiments will be necessary in order to determine its real value.

733 - **The Tucuman Seedling Sugar Canes. First Harvest.** - CROSS, W. E., in *The Louisiana Planter and Sugar Manufacturer*, Vol. LXII, No. 16, pp. 251-252 + 3 Figs. New Orleans, April 19, 1919.

SUGAR CROPS

In February and March, 1917, G. L. FAWCETT, Botanist and Pathologist at the Experiment Station of Tucuman, Argentina, raised 30 Tucuman sugar canes from seed. These canes were harvested in March, 1918. As it is impossible to judge the quality of seedling cane in advance, the cane from such seed must be considered as a distinct variety. For this reason the thirty canes obtained were named Tucuman 1, Tucuma 2, Tucuman 3, etc., respectively, in accordance with the method followed in Java Demerara, etc., whose seedling canes are known everywhere.

The growth of the canes was remarkable; fifteen months after germinating they were from 3 metres to 4 metres high. They suckered very well, some giving as many as 15 to 20 stalks.

In view of the limited quantity of utilisable canes of these new varieties and the necessity of propagating them as rapidly as possible, all the canes cut were planted so as to wait till the next harvest, from which good yields are hoped. It will then be possible to make a study of their sugar content, their chemical composition, and the botanical differences between the varieties.

During the growth of the canes careful observations were made on their relative strength, their manner of growing, etc. The two varieties Nos. 2 and 10 were attacked by top rot (1) and also appeared to be weak in other respects, Nos. 1, 12, and 29 were infested by the mealy bug, Nos. 7, 11, 15, 17, and 30 also did not seem very promising, chiefly on account of their

(1) For cryptogamic diseases of the sugar cane at Tucumán see R., July, 1916, No. 813 (Ed.)

relatively low yield. On the other hand, many canes were particularly vigorous. Among these were No. 5 with 13 long stems of average thickness weighing 20.8 kilos, No. 25 with 20 stems weighing 21.0 kilos, and No. 27 with 18 stems weighing 18.4 kilos. The results given are those of the first harvest.

The thirty new varieties included canes of different colours — green, greenish yellow and purple. Most of them were green.

STIMULANT,
AROMATIC,
NARCOTIC AND
MEDICINAL
PLANTS

734 - **The Effect of Fertilisers on the Composition of Hops.** — RUSSELL, G. A., in the *Journal of Industrial and Engineering Chemistry*, Vol. XI, No. 3, pp. 218-224 + 10 Tables. Easton, Pa., March, 1919.

The field experiments described were carried out during three consecutive years on high land in irrigated alluvial soil. In each case there were fifteen plots, each fertilised in a different manner, and control plots.

It was found that the production per acre of soft resins (extracted with petroleum ether) is greater in irrigated and fertilised soil. This is, however, due to the greater vegetative development of the hop as the percentage of soft resins in the cones is reduced. The results showed no appreciable superiority of one fertiliser over another or a mixture of fertilisers with respect to the production of soft resins per acre. From an economical point of view soft resins are the most important constituent of hops.

The soluble ash content is not appreciably affected either by the use of fertilisers or by irrigation.

735 - **Cultivation of Henbane and the Alkaloid Content of its different Parts.** — KOCH, G. P., in the *American Journal of Pharmacy*, Vol. XCI, p. 68; summarised by BRIDEL, M., in the *Journal de Pharmacie et de Chimie*, Year III, Series VII, Vol. XIX, No. 9, pp. 307-309. Paris, May, 1919.

The author has attempted to find out the best conditions for the cultivation of henbane (*Hyoscyamus niger*) and gives the following recommendations:

Ascertain the germination power of the seed by germinating them on wet blotting paper; in good samples, 90 % of the seed should germinate in 9 or 11 days. If the germination power is tested in soil, this should have been sterilised previously; in this case $\frac{1}{3}$ of the seeds germinate in 3 weeks while, in unsterilised soil, germination, hindered by the growth of mycelial filaments, only takes place in $\frac{1}{10}$ of the seeds.

The growth of henbane is helped by a fertiliser composed of (in parts by weight): — lime, 500; calcium phosphate, 400; sulphate of potash, 200; nitrate of soda, 300; magnesium sulphate, 50.

The most important point in growing this crop is to control insect pests, which may devour nearly all the leaf blade. The author advises the use of a wash containing 5.55 kg. of lead arsenate to 1000 litres of water, as it does not harm the leaves.

In order that the grains harvested should germinate as well as possible, the authors' experience indicates that they should be gathered at the end of July, that is, when the leaves and capsules are dried up and the latter begin to open, and when the seeds are hard and dark brown in colour. By this method seeds were obtained 93 % of which germinated in 9 days.

A single capsule contains from 200 to 300 seeds and one plant will furnish 250 to 270 capsules.

Henbane leaves gathered green, when those capsules that are formed are not yet ripe and when some flowers still remain at the tip of the stalk, are found to contain, on drying, from 0.073 to 0.102 % of alkaloids.

If the leaves are gathered at the end of July, after gathering the ripe capsules, a drug is obtained that, after drying, contains only 0.052 to 0.057 % of alkaloids.

The stems could also be used pharmaceutically if they are gathered at the same time as the leaves; the dry stems, in fact, contain 0.081 % of alkaloids.

736 - **The Production of Market-Garden Seeds in the Belgian Congo.** — FATHER GILLET, in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXVII, No. 5, pp. 145-150. Paris, May, 1919.

HORTICULTURE

Experiments made in the Experimental Garden of the Kisantu Mission.

Results in the production of seeds were registered after using basic slag.

Some "demi-long, blanc de l'hôpital" radishes were sown; the best plants were left and, after some 5 months, they began to flower. As the rains had then begun, only 5 or 6 % of the plants produced pods of sufficient development and containing 2 or 3 seeds, as the others had gone mouldy before they had become full grown. The few seeds obtained were sown as soon as the rainy season had ended and they came up perfectly; after 4 months they began to flower. Since then this variety has well maintained the qualities it acquired in the second generation.

The best time for sowing is the dry or cold season, that which is least different from the European summer. In the rainy and hot seasons, the plants seed before the roots are fully developed; the seed are less well nourished, which would cause them to degenerate rapidly. In fact, during the season when most rain falls, which is also that of the greatest heat, the life cycle occupies about half the time required in the cold season.

The turnips and carrots that bore seed, like the large cabbage, did not give such satisfactory results as the radish.

When first sown, many plants flowered almost immediately and appeared to have reverted to a wild state. Others developed to a certain extent, but formed seed too soon. They were all rejected save those which, being completely developed, were checked before bearing fruit. A good deal of selection work requires to be done before a variety can be obtained that has all the qualities of the first parent, but good progress is being made in this respect. The experiments made so far, though still too recent, suggest that it will be possible to fix good varieties having all the qualities required to make a good vegetable which can also become familiar to the natives.

Five leek plants flowered for the first time in 1916; 3 produced a few seeds; 2, instead of seeds, produces bulbils. When the author left the Congo both lots were very healthy.

Viper's grass reproduced very well from seed, and seed-production does not seem to harm the qualities of the root; this is a very difficult vegetable to acclimatise because it cannot resist rain; it can only be grown in the dry

season. Its seeds are difficult to store as, after 6 to 7 months, they give a percentage of loss of nearly 75 %.

Lettuce, which flowers well, also grows well from seed of the preceding year. Old seed germinates poorly; as with viper's grass, the seed is kept with difficulty from one year to another.

Chinese mustard does well in any season ; it is an excellent vegetable which reproduces itself perfectly.

The tomato loses all the qualities of an improved fruit after the first generation of seeds gathered on the spot. It grows vigorously, producing long thin stems that are covered with an abundance of acid fruit.

The egg-plant and all-spice retain all the qualities of improved fruit.

P peas and kidney-beans are easily acclimatised, when they are more vigorous and give higher yields than the parents.

Some results were obtained with Florentine fennel. This vegetable is very subject to rot when it flowers. It is very difficult to obtain well-formed fruit. Celery, whether grown for the root or the stem, parsley, chervil, the different sorts of cabbage, the salsifies, beet, beetroot, parsnep, sorrel and spinage have given no results so far.

Shallots, which are propagated in the Experimental Garden by dividing the tufts, and oriental garlic have never shown the slightest tendency to bear fruit, although the former had come from seed and the latter from bulbils. Chives, which are also propagated by division of the tufts, might also be grown from seed.

Amongst the onions, apparently only the native onions give good results ; the different European varieties form no bulbils ; only the variety known as Santa Cruz or Tenerife grows well, but so far it has borne no seed.

Good results are expected from the " ranevelle " radish, which is on trial. Some were obtained in the third generation that were 10 cm. in diameter and that without any trace of fibre ; the pods are also modified, some losing their appearance of a string of beads ; their more tender skin can be crushed between the fingers ; in this third generation types are found that range from the wild plant to the perfect vegetable.

Potatoes are grown at Kisanu throughout the year. In the dry season they are grown on the flat (as is done in Europe, in clay or loamy soil that can easily be watered or irrigated).

The author describes the cultivation of the potato in the region, the harvest (which should only be taken when the soil has dried ; as soon as the tubers have dried a little they should be bagged and put in the shade to dry, for the sun might kill them completely); the way they are stored (in a cool, dark, dry place). Except in places where trees have recently been cleared away, the potato requires manuring (farmyard manure and wood ashes).

737 - **Comparative Cultural Tests of different Species and Varieties of White-Currants, Black-Currants and Gooseberries in Denmark.** — ESB JÆRG, N., in the *Tidsskrift for Plantavl*, Vol. XXVI, Pt. 1, pp. 52-79 + 18 Tables. Copenhagen, 1919.

The agricultural station of Spangsbjerg undertook, in 1909, a series of comparative cultural tests of different varieties and species of white-currants, black-currants and gooseberries. Fifteen varieties of gooseberry,

4 of white-currants, and 4 of black-currants were planted, at the rate of 80 plants to a plot. The plots were limed some time before planting and then given progressively decreasing amounts of sulphate of ammonia and superphosphate together with approximately constant amounts of potash each year. The first crop was gathered in 1911. Each year the author recorded, for each of the 23 varieties, the dates of flowering, setting, harvest and fall of the leaves, in this way he observed the relative resistance of each variety to fungoid disease and insects. Below are given the total crops of fruit obtained from 1911 to 1917 (in quintals per hectare): —

A) GOOSEBERRIES: — 1) *Varieties with red fruit gathered when ripe*: Achilles, 1237; Sproffens Goliath, 1119; London Market, 982; Winham's Industry, 724; Crown Bob, 675; Non plus ultra, 492; Victoria, 315; Williams, 300.

2) *Varieties with green fruit gathered ripe from 1911 to 1914 and unripe from 1915 to 1917* (the crops for 1915-1917 are given between brackets): Withesmith, 414 (741); Keepsake, 307 (649); Gottlieb 214 (593); Green Willow 248 (538); Brougham, 133 (447); Profit 249 (365); Favorite, 133 (240).

B) WHITE CURRANTS: — Red Dutch, 433; Fay's New Red Prolific, 212; Cherry Dutch, 187; Fertile, 105.

C) BLACK-CURRANTS: — Black Naples, 313; Bang up, 396; Queen Victoria, 275; Ogden's Grape, 217.

738 - **The Management of Fruit Trees Before Plantation.** — TRUELLE, A., in *La Vie agricole et rurale*, Year IX, No. 10, pp. 182-176 + 1 Plg. Paris, March 8, 1919.

The operation of "dressing" (habillage) a tree before planting is well known and the author quotes experiments made on this procedure, which has the double end of trimming the tree and establishing a balance between its subterranean and aerial apparatus.

There is another operation that is much less used but ought to be used more often, as trees removed from the nursery have often to wait a long time before being planted. This operation, known in France as "pralinage", consists in plunging the root system of the tree for a few seconds in a mixture made of clay, a fertiliser and water. The mixture should be so thick as to stick to the roots and form a covering. The proportions used vary.

The aim of the operation is to give back their freshness to the roots and rootlets that are more or less dried up by their journey from the orchard or by the heat of the sun and provide them with food that they can make use of immediately, so that the tree will "take" more quickly.

The mixture consists of clay with cow-dung in the proportion of $\frac{1}{3}$ of the former to $\frac{2}{3}$ of the latter, sufficient water being used to obtain the required consistency.

It is advisable to mix 5 shovelfuls of clay with 3 of cow-dung and dilute the mixture with sufficient water to make a "clear soup".

The stems can also be treated with this mixture by using a large brush, but it is best to lime them, as lime is the chief constituent of the mixture used for coating, whitewashing and spraying stems.

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The operation is intended to prevent the young trees, which, being sheltered by one another in the nursery, have tender bark, from hardening it rapidly when they are finally planted under the influence of the sun and wind, in which case the bark would lose its elasticity, the stem would grow in girth more slowly and the flow of the sap would be hindered. For this purpose, fairly concentrated milk of lime is used, mixed with $\frac{1}{4}$ its volume of clay or loam so that the coating will not be easily washed off by the rain.

739 — **Fruit Growing in Denmark.** — GRAM, M., in the *Tidsskrift for Planteavl*, Vol. XXVI, Pt 1, pp. 80-182 + 5 Tables Copenhagen, 1919.

Report of the inquiry made by the Fruit-Growing Commission nominated by the official Danish Committee of Agriculture.

This report, which deals with the development and present state of fruit growing in Denmark, gives the following information: —

1) Statistics showing the number and distribution of fruit trees in the country.

The following figures were available on July 15, 1912, for the islands and Jutland: — total number of fruit trees, 3 224 078 and 2 210 332; comprising apple trees, 1 267 131 and 868 163; pear trees, 561 397 and 383 973; plum trees, 704 451 and 456 733; cherry trees 691 099 and 501 663. This gives, for the whole country, 5 434 410 fruit trees: 2 135 294 apple trees, 945 370 pear trees, 1 160 984 plum trees, 1 192 762 cherry trees. Of the 18 Danish counties, the 6 containing most fruit trees are the 4 counties of the islands, i. e., Odense, Praesto, Svend borg and Mariho, and 2 counties in the east of Jutland, Aarhus and Tanders; the 6 poorest counties in this respect are those in the north and west of Jutland. Broadly speaking, it may be said that apple, cherry, plum and pear are present in equal numbers in the different parts of the country, owing to the fact that over a large area the chalky subsoil is so close to the surface that it provides a continual supply of chalk to the cultivated layer, which constitutes a factor that greatly favours the growth of fruit trees. The scarcity of fruit trees in the north and west of Jutland is due to the lack of chalk in the soil and, in many cases, to the poor soil, which is mostly sand. One of the counties richest in cherries (varieties with sweet fruit) is that of Frederiksborg (in the north of the island of Seeland) which supplies the Copenhagen market with fresh fruit.

II. — The second part of the report deals with the results obtained by sending lists of questions relating to local fruit-growing conditions to communes, farmers, horticulturists and school masters; 74 % of those who received the questions replied to them; the questions were as follows:

In what part of the district is most interest taken in fruit growing? In what parts has progress been made? What parts are most suited to fruit-growing on account of climatic and agricultural conditions? How do the different species and varieties grow? In what way are they cultivated? What are the commonest diseases and which are the resistant and which the susceptible varieties? What possibility is there of developing and intensifying fruit-growing and what are the economic conditions required to realise this?

Examination of the replies shows that the interest in fruit-growing varies very greatly with the locality: in regions where it has been carried on for a long time, such as in the islands and the east of Jutland, the importance of the crop as regards commercial exploitation has increased on the whole, and even in parts of these regions that are poorest in fruit trees, every farmer can grow sufficient to supply domestic needs. However, more attention is paid to plantation than to maintenance and it may even be said that in many places maintenance leaves everything to be desired. It may be said roughly that, about one-half of the countries where fruit-growing is carried on show conditions that can be described as favourable, while the other half shows unfavourable or bad conditions.

Fungoid disease causes a great deal of damage, especially due to *Sphaerotheca mors-uvae*, *Nectria ditissima*, *Venturia*, and *Monilia*. In comparison the climatic conditions are less important, the most harmful being the west wind, which causes most damage in Jutland, frost, hoar-frost and fog. The various unfavourable conditions of the soil, such as acidity, lack of natural drainage, lack of lime, are less important and the damage due to insect pests still less.

All the species and varieties grow best in the islands, especially in the southern ones (Fionia and Laaland). Walnuts, chestnuts and mulberries grow there as well. In Jutland only the most hardy fruit trees can grow, and bush-fruit such as *Ribes* spp. Fifty varieties of apple, 30 varieties of pear, 20 varieties of plum and 12 varieties of cherry (9 with sweet and 4 with sour fruit) are grown. The commonest varieties of apple are Cox's Pomona, Cox's Orange, Skovfogedaehle fra Lou (Danish), Monnetille (Prince) and Gravensteiner. The most esteemed variety of pear is the Danish variety Græve d. W. Moltke; next come the Bonne Louise, Graapaere and Bon Chrétien Williams varieties. Among cherries the yellow and black Spanish, Napoleon and Elton varieties are mentioned. In 50 % of the communes, fruit-growing is of no commercial importance and it is only in about a hundred (i. e., 10 %) communes that fruit selling is of any economic importance. In the regions where fruit growing is relatively important, the fruit is sold to whole-sale buyers or in the markets: in other places the consumer buys directly from the grower. Little sorting is done and the methods of packing and storage are still somewhat rudimentary.

Some 300 communes (about 1 % of the total number) have commercial plantations, but they are mostly small, the largest only covering an area of 20 to 25 hectares. Various bodies or societies give assistance to Danish-fruit growing. These are particularly the horticultural societies, the small farmers' societies ("Husmands-foreninger"), the agricultural societies, etc.

740 - **Researches on the Efficacy of Thinning by the Study of Promising Trees chosen in the Stand.** — MER, F., in the *Comptes Rendus de l'Académie d'Agriculture de France*. Vol. V, No. 13, pp. 430-440 + 1 Table + 1 Fig. Paris, April, 1919.

The author attempted to ascertain whether it is possible to estimate with sufficient accuracy the results of thinning by studying a certain num-

ber of promising trees in a recently thinned stand. These would be numbered and fenced off; their circumference at the level of the fence would be measured every few years and their average height would be calculated; with the help of these data the average surface at the level of the fence would be calculated, then the average volume produced during the different phases of the period selected; by multiplying this average volume by the number of promising trees in the stand, i. e., those trees that must stand until the last years of the rotation, and which will be taken into account for each plot, the material yield of the most vigorous trees in each plot could be rapidly calculated with sufficient exactness.

By adopting this summary method the need for felling a certain number of trees of different categories in experimental areas in order to work out tariffs could be dispensed with as it has the disadvantage of impoverishing the stands and bringing a certain confusion in the inventories.

But, before making use of the method suggested by the author it would be necessary 1) to make sure that the trees selected in this isolated fashion in the stand have been influenced sufficiently by the thinning for their growth to have appreciably increased, even after quite a small number of years, 2) to ascertain whether the average volume of these trees corresponded sufficiently with that of the promising trees in the small experimental area serving as a control, for only in this case could the two be compared. In order to see whether these two ends could be attained, the author carried out the following experiment:

In an experimental area some 60 years old and divided into 2 small squares *A* and *B* (the latter less thinned) the author placed 7 promising firs in the first square and 13 in the second, under observation in 1886. The trees were chosen in such a way as to have approximately the same dimensions as the other promising trees. The trees were measured, fenced, etc., as has been previously described. New measurements were taken in October in 1899, 1902, 1907 and 1911. At each of these periods the average circumference and, consequently, the surface at the level of the fence were calculated, then the volume of each tree, the height of the trunk being estimated as an average of 10 metres, as owing to the war actual measurement could not be carried out. After each set of observations, the *average volume of the firs forming each of the groups* was calculated and by multiplying it by the number of promising trees in one or other of the squares, the *cube* could be determined, based in this way on the *average volume of the fenced-off trees*.

It could then be judged if the cube obtained in this way corresponded, with sufficient approximation, to that of the whole of the trees supplied by the inventories. These figures, expressed in cubic metres per hectare, are given in the form of tables and graphs.

Examination of the table shows that, for each of the small squares, the difference between the volume of the fenced-off trees, calculated from the inventory figures for the promising trees, and the volume of these trees in each small area, is relatively small — for the first small square, $369 - 318 = 51$ (i. e., 1.49 %) and, for the second small square, $448 - 417 = 31$

(i. e., 6.9 %). The volume produced by the fenced-off trees, calculated from the number of promising trees recorded in the inventory, is thus sufficiently close to the ascertained volume of these promising trees to allow the two figures to be taken as practically equal.

The number of trees fenced-off in each square was small and it is probable, that if it had been greater, the difference would have been still less.

In conclusion, the author advises foresters who wish to apply this method to take the following precautions :

- 1) to place the experimental and control areas in stands that are as regular and homogeneous as possible ;
- 2) to number, in groups by size all promising trees in each area ;
- 3) to pick out, from each of the two areas, as trees to be numbered and fenced-off from 30 to 50 trees per hectare, according to the situation, choosing them in various grades of size, so that the average circumference of each of them would be near that of the trees in the rest of the area.

741 - **The Identification of Timber by the Colouring Matter it contains.**— JAUFFRET, A. in the *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 13, pp. 693-694. Paris, March 31, 1919.

The study of the colouring matter in wood is not only of practical interest, but also enables the species to which the wood belongs to be identified by examining the colour reactions and the absorption spectra of the colouring matter.

An example of this is furnished by the author's researches on two *Dalbergia* from Madagascar : *D. Perrieri* Drake, and *D. ikopensis* Jum. & Perr. Normally, the former has a colour like wine lees, while the latter is a less dark brownish red. After soaking for 24 hours in 95% alcohol, the powdered wood of *D. Perrieri* gives a solution that when filtered is red, and which turns orange on adding sulphuric acid. Under the same conditions the solution from *D. ikopensis* is orange coloured, is not changed by sulphuric acid, and is turned orange brown by caustic soda, etc. On the other hand, the powders of these two woods give differently coloured solutions on treatment with ether, chloroform and benzene; their alcoholic solutions also give different absorption spectra.

The author has found that these characters are constant for a given species by studying numerous species all of which, from this point of view, have quite distinct characters. It will be seen how tables based on these reactions and on the absorption spectra of these coloured solutions would be useful for the identification of timber in general, and especially for timber imported under indefinite names, provided that these tables are gradually drawn up with the help of samples of known botanical origin.

742 - **The Forest Resources and Timber of the French Colonies.** — I. BOUTTEVILLE (Inspector of Public Works in the Colonies), *Les Ressources de nos forêts coloniales*, in the *Bulletin de la Société d'Encouragement à l'Industrie nationale*, Year CXVIII, 1st. Half-Year, Vol. CXXXI, No. 2, pp. 258-283. Paris, March-April, 1919. — II. CARMENTRON, E., *Bois coloniaux*, in the *Actes de l'Institut colonial de Bordeaux*, summarised in the *Bulletin de l'Office colonial*, Year XI, Nos. 121-122, p. 79. Melun, Jan.-Feb., 1918. — III. *Note officielle*

sur les bois coloniaux, in the *Bull. de la Soc. d'Enc. pour l'Ind. nat.*, Year CXVIII, 1st. Half-Year, Vol. CXXXI, No. 2, pp. 284-298. Paris, March-April, 1919. — IV. FRANÇOIS, G., *Produits de la forêt et de la brousse arborescente*, in the "Ressources de l'Afrique Occidentale Française", *Ministère des Colonies*, Colonial Office, p. 156. Melun, 1918. — V. GUIBIER, J. F. H. (Chief of Forest Service of Annam), *Situation des forêts de l'Annam, Congrès d'Agriculture coloniale, Gouvernement général de l'Indochine, Saigon Series*, Bulletin No. 9, p. 114. Saigon, 1918. — VI. COUFFINHAL (Chief of the Forest Service of Cochinchina), *La situation actuelle des forêts de l'Indochine, Ibid.*, Bulletin No. 8, pp. 30 + L. IV. — VII. GOURGAND, E. (Chief of Forest Service of Cambodia), *La situation forestière du Cambodge en 1918, Ibid.*, Bulletin No. 10, pp. 31. — VIII. MERSHIER, A., *Les Forêts du Tonkin, Congrès d'Agriculture coloniale, Gouvernement général de l'Indochine, Hanoi Series*, No. 13, pp. 23. Hanoi-Haiphong, 1918. — IX. CHEVALIER, A., *Premier inventaire des bois et autres produits forestiers du Tonkin*, in the *Bulletin économique de l'Indochine*, Year XXI, No. 131, pp. 505-525 and No. 132, pp. 742-884. Hanoi-Haiphong, 1918 (to be continued in 1919). — X. BERTRAND, A. *Les produits forestiers de l'Indochine au service de la Défense nationale, Congrès d'Agric. col., Gouv. gén. de l'Indochine, Saigon Series*, Bulletin No. 18, pp. 18. Saigon, 1918. — XI. HEBERT STONE, *Les bois utiles de la Guyane Française*, in the *Annales du Musée Colonial de Marseille*, Year XXV, Third Series, Vol. IV (1916), Pt. 2, pp. 39-135 and Year XXV, third Series, Vol. V (1917) Pt. 3, pp. 159. Paris-Marseilles, 1917. — XII. *Bois de Madagascar*, in the *Annuaire général de Madagascar et Dépendances*, pp. 454-455. Tananarive, 1918. — XIII. GARDEY, A., *Les Ressources forestières du Maroc*, in *Colonies et Marine*, Year III, No. 1, pp. 33-40. Paris, January 25, 1919. — XIV. LONGO, *L'exploitation des forêts au Maroc*, in the *Revue des Eaux et Forêts*, Third Series, Year XVI, Vol. LIV, No. 6 pp. 178-181. Paris, 1916.

I. — Statement of the timber required in France. Before the war the home production of common timber was 8 million cubic metres while 3½ million cubic metres of an estimated value of 275 million francs were imported.

France has 10 million hectares of forests ($\frac{1}{6}$ of its total area). Colonies (in millions of hectares of forest): — Ivory Coast, 12, Gabon and the inland region, probably 20; Cameroons, 15; Madagascar, 9; Guiana, 5; Indo-China, 25; etc.; the total for the colonies appears to be about 100 million hectares. A large part of these forests is at present of very difficult access, but it forms an immense reserve for future use. Accepting the relatively modest figures of 250 cu. metres per hectare, the forest reserve would be 25 milliard cu. metres of wood.

Apart from the valuable timber, the colonies can supply excellent common timber. The author describes the colonial forest and points out that an inventory of the colonial forests has begun, while various missions have been organised and work carried out. It was important that the colonial trees should be classified methodically; this was done for the Ivory Coast and Gabon (1) by Commandant BERTIN (the same results were obtained for the other African colonies), whose work is briefly described by the author. M. A. CHEVALIER had identified 600 trees, but Comm. BERTIN retained 39 species of trees that answer to industrial requirements and which form 70 to 75 % of the forests examined. The samples brought back by

(1) A. BERTIN, *Mission forestière coloniale*, Vol. I, *Des bois de la Côte d'Ivoire*, published by E. J. AROSE, 11, rue Victor Cousin, Paris; Vol. II, *Les bois du Gabon*, Id.; Vol. III (in 2 parts) *La question forestière coloniale*, Id. (Ed.)

M. BERTIN were submitted to very interesting practical tests, which gave conclusive results, by M. PRUDHOMME (Director of the Jardin Colonial), Commandant CÉLIERIER and M. BERTIN himself. A special commission set up by the Minister for the Colonies considered the results obtained and classed the timber from the Ivory Coast and Gabon in 7 grades corresponding to the different uses of industrial wood. The author considers these 7 grades of wood with regard to their employment for railway sleepers, vats, paving, paper pulp, etc. Much has been achieved, but much still remains to be done in exploiting and utilising colonial timber, and the author gives a detailed account of the work to be done by the Administration (creation of ways of communication, suitable ports, jetties near the mouths of rivers, development of the mercantile marine, etc.); saw-mills should be set up in the colonies in the timber yards and ports; the State should become a buyer in order to ensure a suitable utilisation of the products and a desirable and safe market. As regards the economic point of view, M. BERTIN has shown that, taking into account all expenses, colonial timber can be put on the French market at equal and even inferior prices to those of French or foreign timber.

II. — Official communication classing the common timber (not including the valuable timber known as "island timber") of the Ivory Coast and Gabon in 7 grades. The different woods are given the Latin name of the tree that produces them together with its local name, and its characteristics.

III. — A study on the increased utilisation of colonial timber and the multiplication of markets so as to exploit the forest resources of Africa more rapidly.

IV. — This study on the products of the forest and bush in French West Africa was summarised in our *Review* of Feb. 1919, No. 146.*

V. — The area of the Annamese forest cannot be stated exactly; the estimate of 6 million hectares, given to the Forest Service some years ago as an indication of the wooded area it would have to deal with, fixed the area at $\frac{1}{3}$ of the total area of the country. This figure is much too low, if by "wooded area" is understood all that which, not being suitable for the cultivation of crops, bears remains of old forests that ought to be reconstituted, if it were not impossible until the yearly forest fires can be prevented. It is much too high if by forests is understood those areas that bear stands that can be exploited and stands that can be reconstituted simply by protecting them from fire for 5 to 10 years.

These forests extend uninterruptedly from the north to the south of Annam, being continuous with the Tonkin forests at the north, the forests of Cochin-China in the south and the forests of Laos in the west. They preponderate in those districts that are hilly if not mountainous.

Under present conditions of exploitation and transport, the Annamese forests could export large quantities of all kinds of wood suitable for different uses to the home country. These forests without mentioning the pine forests, could easily supply 100 000 cu. metres of timber each

year without being depleted, if the felled trees were utilised better, and more than double that quantity of ordinary wood.

From the special point of view of the Lang-Bian pines, the possible annual yield from 50 000 hectares of forests in that region was estimated in 1913 at 100 000 cu. metres for the pine alone, which would bring in a gross revenue to the Treasury of 100 000 piastres, the pine being placed in the third grade (but which would be \$200 000, as it is now placed in the second grade). The forests of the province of Lang-Bian cover more than double that area. An estimate made in 1909 spoke of 100 000 hectares and fixed the minimum possible annual yield at from 400 000 to 600 000 cu. metres, which would give 10 000 tons of sulphite paper pulp.

Judging from these figures, the forests of Annam could yield a total of nearly 1 million cu. metres, or $\frac{1}{4}$ to $\frac{1}{3}$ of the French importation. It would be nearer the truth if these figures, including those of Lang-Bian, were reduced to a total of 300 000 cu. metres.

The author gives tables showing the timber that could be exported to France. The tables show the names of the trees, the forestal divisions of the country where they grow, information as to their utility, the price per cu. metre of undressed timber at Benthuy for North Annam, Tourane for Central Annam and on the spot for South Annam.

Another table shows the forest by-products that could be exported to France (bamboos, rattans, various palms, etc.). In a further table the composition of the stands in Annam is shown. Other tables and diagrams give information as to the reserves, the actual volume of wood exploited, receipts obtained, reforestation and the fixation of dunes, the yield in gum of the pines, etc.

VI. — The forests of Cochin-China consist of two distinct natural zones: that of the East, or elevated land, and that of the West, or inundated or marshy land. Between these two regions lies a central zone including the provinces of Cholon, Tanau, Mytho, Gocong, Bentré, Travinh, Socrang, Cautho, Vinhlong, Sadec and Longanyen. These provinces are either almost entirely devoted to rice growing or covered with marshes, but there are numerous small woods that furnish considerable quantities of fagots sold as firewood.

The elevated forest land is the most important as well as the oldest. The forests of which it is composed are of very varied character but mostly appear to have been devastated centuries ago. The stands are made up of a large variety of trees; these grow any how, mixed with all sorts of plants, shrubs, lianas, rattans, bamboos, etc., forming an impenetrable thicket.

The inundated forest region includes two different zones: that of the mangroves and that of the "tràm" (*Eustathes sylvestris* Genibre), as mangroves require salt water for their growth and the "tràm" grow in fresh water, though they can occasionally stand weak salt water. The forests in this region consist of pure or almost pure stands.

The forest products and by-products are next considered. From the point of view of exportation, the author thinks that it is now possible to

export, not heavy timber requiring much tonnage, but a smaller class of wood, suitable for telegraph poles, struts, poles, cases, toys, etc. Similarly, the by-products (rattans, bamboos, lianas, tanning and dyeing barks, oils, resins, etc.) exist in sufficient quantity to be exported. Many products such as paper pulp, acetic acid, tar, creosote, methylene, methyl alcohol, etc., should be prepared in the colony as they would easily find a market in France.

After considering the regeneration of the forests (reafforestation, fire control, foundation of artificial stands), and the organisation of the Forest Service of Indo-China, the author gives in tabular form a list of the chief trees present in the elevated forest region of Indo-China (together with much information), the nomenclature of the species living round the edges of the mangrove swamps, figures showing the quantities of wood exported (by grades and species) during 1916, the area covered with timber in each province, the number and area of the forest reserves, and the receipts of the Forest Service from 1906 to 1916. A note is given on the *Arboretum of Trung-Bom*, and the decree of December 1, 1913, regulating forest control in Indo-China is quoted in full.

VII. — The forests of Cambodia cover an area of at least 4 million hectares. They are divided into 3 groups: — inundated, open, and close forests.

The inundated forests occur on low lying ground near the banks of the Mekong, Bassac, Toulé-Sap and their numerous tributaries. At the annual rising of the waters, occurring from June to November, these forests are totally inundated, the water sometimes even covering the tops of the highest trees; when the waters go back they leave on the soil a thick layer of mud of exceptional fertility. These forests contain trees of but inferior quality, amongst which water rattans, lianes, etc., grow in thick, impenetrable masses. They have been long exhausted by extensive exploitation and are in a very bad state. In time they will disappear as their soil is required for agriculture, rich soil being scarce.

The clear forests are usually on fairly shallow, uneven, impermeable soil. The chief trees are the "phchek", "okram" (Rubiaceae), "thbeng", "trach", "khleng" (Dipterocarpaceae), which live isolated without any underwood; the trunks are not very high and reach a maximum diameter of 20 in. only.

The close forests situated on the banks of the chief rivers have been ravaged by the natives, but numerous woods situated a few miles from water courses that would float wood are still practically intact.

The Cambodian forests could supply France with many kinds of wood enjoying a current sale, forming a large selection of beautiful cabinet-making wood, carriage, cask and building wood as well as railway sleepers, etc.

The author studies forest control in Cambodia, the reserves, forest work, the "rays" (native method of cultivation consisting in burning down the corner of a forest in order to sow crops in the ashes) and forest fires, customary rights, exploitation (timber, firewood, by-products), the trade in

wood and exports. He gives a list of the chief woods that could be utilised in France and of the by-products that could be used industrially (resins, oleo-resins, oil products, gums, guttapercha and rubber, textiles and plants for paper pulp, tanning and dyeing). Some diagrams are given, together with a map showing the administrative organisation of the Forest Service in Cambodia.

VIII. — Three zones are distinguished in Tonkin: the Delta (about 3 700 000 hectares), the Middle and Upper Region (a total of about 6 700 000 hectares). In the Delta the soil can be cultivated and there are no forests. In the Middle and Upper Region it is nearly all forest soil, but there are so many gaps, so much deforestation, that the wooded area can be reduced to 3 500 000 hectares of which only 279 345 hectares have been reserved, i. e., are under the control of the Forest Service, which has regulated 49 848 hectares.

Compared with the stands in Annam, Cochin-China, Cambodia and Laos, those of Tonkin are distinguished by their poverty both as regards the quality and the quantity of the wood. Except the mangroves and pines in the Quang-yen province (2 leaved pines) and a few groups of 3-leaved pines in the Ha-giang region which form pure stands, all the trees composing the stands in Tonkin are mixed in an excessively varied manner, which is a defect from the point of view of the trade in wood.

The exploitation is in the hands of the natives, except the parts that are reserved and regulated, and it is carried out by ancient methods.

The author considers in turn the possibilities of the forests in Tonkin, their future, the reserved areas, the areas regulated, the attempts at re-forestation, the salt forests (80 000 hectares of mangroves), the different timbers exploited (the timbers are at present classed in 4 grades, which the author studies separately, giving tables showing the native names of the trees, the respective volume exploited in 1916, the price per cu. metre of rough timber and the chief uses), woods for dyeing and tanning, the forest by-products, the bamboo, the "Cunâu" (1), the resins (resin from the pine *Pinus Tonkinensis*, and that of the "trâm", *Eystathes sylvestris* Geniêre, resin from the "sâu", *Liquisambr formosiana*, and "bô-dê", probably *Styrax benjoin*), the rattans, the "Lui" (*Rhapis flabelliformis*), etc.

Amongst the many trees in the forests of Tonkin, there are few that could provide the material for a small exportation. Tonkin even imports its "lîm" as rough timber from Annam. Generally speaking, the distribution of the wood and its variety do not satisfy commercial requirements, an uniform product being demanded. Again, the many and varied difficulties inherent to the country make it impossible for the European to exploit the forests himself. There is room, however, for one or two new paper mills (two already exist) as well as for one or two firms that would deal with the resins, the tanning and dyeing material and the perfumes.

(1) As regards the "Cunân" or "Cu-nâu", see R., Nov. 1918, No. 1236. (Ed.)

IX. — After studying the forest problems of Tonkin, the author gives a list of the trees of that country, grouping them in families and giving much information regarding each of them (scientific names, native names, sizes, properties of the timber, uses, prices, geographical distribution).

X. — The author deals with the use of the forest products of Indo-China for National Defence: rough parts for rifles made of "goi" wood in Tonkin; the manufacture of these parts in Cochinchina and shipment of blocks of "bang-lang" wood; general information on bang-lang wood, which is very important; tests on the use of light woods; study of heavy woods that might replace "gaiac"; the provision of kapok; supplies of acetone and methylene furnished by the "Bienhoa Industrielle et Forestière" Company (at Tan-mai, near Bienhoa); the resins produced by the Dipterocarpaceae of Indo-China.

XI. The object of this work was to collect and compare all the available information on the timber of French Guiana, to clear up both the scientific and popular synonymy and to provide supplementary descriptions of all the species represented in the Colonial Museum of Marseilles or in other collections that the author was able to visit. He also desired to call public attention to the rich forests of Guiana.

In the introduction the author gives a general account of the timber, deals with the synonymy of colonial trees and the classifications of timber made by Dumonteuil and the Brest Commission.

The descriptive account of the timbers of French Guiana is done by families and tribes, giving each tree its scientific, popular and native names together with information as to its habitat and the properties of the wood as well as the uses for which it is suited. The work is illustrated by 7 plates.

XII. The forests in Madagascar are of very special character, being composed of many kinds of trees (800 to 1000) scattered about with no apparent order; there are no dense stands that could be worked easily. The trees occur on the east coast according to the altitude: over sea-level; between sea-level and 720 ft. trees occur that are some of the best produced by the colony; from sea level to 4550 ft. there are the same and very different trees, new trees occurring from 4550 to 6666 ft., but at that altitude the forests cease.

The coastal forests on the bay of Antongil and those situated to the south of Maroantsetra are the finest in the colony, as they contain the most valuable trees and the densest stands: *Alzulia bijuga* ("hintsy"), *Trachylobium curruosum* (copal tree), *Labranis Bageri* ("nato"), etc.

The forests situated along the railway in the Analamazaotra region are also very fine and rich; they furnish timber and firewood for the towns in the centre that cannot obtain sufficient from the second zone of the "Mandraké" forests, which are already partially exploited.

The Malagasy forests are usually too varied in character to allow of regular exploitation with the object of exporting one particular kind of timber. This is specially true for the eastern forest, which is the most heterogeneous.

The west coast, especially the province of Morondava, contains important stands. The *Diospyros Perrieri* (ebony), *Dahlbergia Perrieri*, *Skopensis* (violet ebony) and the "Hazomalama" (which has aromatic wood) are among the trees on the west coast.

Apart from botanical studies carried out by the Forest Officers in Madagascar and by various botanists, no practical studies have been carried out on the timbers of the colony.

Besides timber the forests can furnish numerous by-products, such as wax, gums, resins, fibres, tanning and dyeing material. Other by-products that might be used for making paper-pulp have not yet been identified.

XIII and XIV These two articles, on the forests in Morocco have been respectively summarised in this *Review* in No. 475 of April, 1919 and No. 49 of January, 1917.

743 - **Forestry in the Union of South Africa.** — I DOMINION'S ROYAL COMMISSION Industrial Possibilities of South Africa, 1, Forestry Resources *The South African Journal of Industries*, Vol I, No. 2, p. 159-160, Pictoria, 1907 — II *Id. id.*, Forest Products *Ibid*, No. 3, p. 215-216 — III Industrial Development and Research Reports of ADVISORY BOARD AND SCIENTIFIC AND TECHNICAL COMMITTEE, TIMBER RESOURCES, *Ibid*, No. 10, p. 861-868, 1915 — IV Forestry in the Union, Annual Report of the CHIEF CONSERVATOR OF FORESTS *Ibid*, No. 11, p. 1036-1047 — V LUGAT C. E. Timber Supplies and Forestry in the Union *The South African Journal of Science*, Vol. XV, No. 2, p. 70-99, Cape Town, 1918

The question of the timber resources of the Union of South Africa and how best to make this valuable asset available for general industrial purposes has been carefully considered by the Industries Advisory Board appointed by the Minister of Mines and Industries of the Union of South Africa.

It was ascertained that there are over 2 000 000 acres that normally fall under the control of the Forestry Department; but a large proportion of this area, some 1 530 000 acres, is waste land, extensive areas of drift sand along the coast, and mountain tops unsuitable for afforestation, but reserved at the instance of the Irrigation Department. The area of dense forest timbers, on Government reserves, is given as 400 000 acres, while privately owned forests total 100 000 acres. Something like 1 000 000 cubic feet of usable timber are annually handled in these forests and a similar amount is probably converted into firewood. The total annual value is estimated at £ 25 000. A considerable quantity of this timber consists of yellow-wood, which was formerly used largely for building purposes with satisfactory results when it was properly handled.

There are some 70 000 acres of plantations consisting of a number of imported species of trees, some of which have been found to grow with great vigour and to be capable of producing excellent mercantile timbers.

This makes a total of 470 000 acres of land under forest under the supervision of the Forestry Department.

No systematic investigation of the nature and use of the indigenous timbers has been undertaken and little appears to be known in regard to methods

of seasoning. It is stated that a considerable wastage of most valuable timber is constantly taking place. This is said to arise from a shortage of scientific staff and from the impossibility of controlling the depredations of natives. Much destruction of useful timber takes place in connection with the cutting of poles for mining purposes, and it frequently happens that immature and growing trees are felled by their owners for this purpose, thus destroying what would later have become an exceedingly valuable asset. Four hundred thousand acres of indigenous forests must have a very considerable value over the whole period of growth and in some cases must be equal to that placed upon ordinary plantations in European countries.

A considerable proportion of the unworked timber which in the past has been imported into South Africa, could be supplied from South African forests in increasing quantities, but this will depend very largely upon the action taken to remove prejudice and facilitate the handling of the timber, and also upon the transport and other difficulties attendant upon extensive importation.

The Industries Advisory Board is of opinion that the Union possesses in its forest resources an asset, the value of which is greatly under-estimated, because little is understood of its intrinsic worth. It would appear that the following are among the urgent necessities of the case: (1) A forest survey; (2) determination of the commercial use and value of South African timbers; (3) encouragement in the use of local timbers; (4) the conservation of existing immature forests; (5) the prevention of wastage and of the uneconomic use of timber; (6) experiments in felling and seasoning.

The Advisory Board is also of opinion that the plantation area should be at once increased by planting of serviceable timber trees, in the proportion of at least two for every one destroyed or felled.

According to the annual report of the Chief Conservator of Forests of South Africa for the year ending March 31, 1917, the funds allotted to the Forestry Department were again restricted, owing to the Government's desire to curtail expenditure during the war, and the area put under trees was only 2 655 acres. Of the total area of 70 731 acres which has been planted at the Cape since 1876, most has been done during the last 15 years. The acceleration of the afforestation programme is in the main a matter of money, though during and for some time after the war the shortage of staff and the difficulty of procuring seed from overseas would have to be contended with.

That there is ample room for extension will be appreciated if it is realized that during 1913, the last normal year, approximately 10 000 000 cubic feet of unmanufactured pine timber, of a value of £529 000, was imported into the Union. In addition, over £500 000 worth of manufactured timber, of which a large portion would be coniferous wood, was brought from overseas. Thus a conservative estimate of the consumption in normal times of pine timber alone in the Union of South Africa is 15 000 000 cubic feet.

There can be little doubt that wood to take the place of the bulk of imports can be grown in South Africa. Considerable areas of suitable ground are already in the Government's possession, and if more is required there

should be no difficulty in acquiring it reasonably. It is estimated that 250 000 to 300 000 acres at least would have to be put under trees to meet the country's requirements. At the present rate of progression a century would have to elapse before that object could be achieved and therefore it would seem desirable, as soon as money can be found, that operations should be speeded up.

As a result of the war, the Union has been thrown on its own resources more than ever before, and in this respect timber supplies have not furnished any exception. The high price of imported timber, due to the rise in freight and the difficulty of getting material for special purposes, such as wood for match making and for fruit, butter, and cheese boxes, have directed attention to local sources of supply. The match factories have been running entirely on South African material, and numerous box factories have sprung up at various places throughout the country.

Large quantities of locally grown pine (*Pinus Pinaster* and *Pinus pinea*) mainly from the south-western Cape, and of blue gum (*Eucalyptus Globulus*, generally called Gray Box), from Natal have been sent up in the round to the Rand and have been sawn up into various sized scantlings and successfully used to replace Douglas fir and other imported timbers. Reports received indicate that the pine compares favourably with much that is imported, and everything goes to show that if the supply were equal to the demand this domestic pine could maintain its hold on the market even after the war. As indicating the very considerable consumption of timber on the Rand, it was stated by a representative of one of the mining groups that their companies consume 7 000 tons of South African timber monthly, of which roughly half is used in the form of props and the other half is sawn. The representative was of the opinion that his group absorbed about one third of the total consumption of the Rand. If that is so, the South African timber used on the Rand would amount approximately to 250 000 tons per annum.

The effect of this demand for local timber has been to draw attention to the practical value of tree planting and to stimulate the planting of trees by farmers and landowners generally. This has been particularly marked in Natal, though in the aggregate probably more trees are planted in the Transvaal than in any other Province.

The following table reflects the changes in State forest-estate areas, and the position on March 31, 1917: (see table pag. 705).

The total forest area on March 31, 1917, was thus 1 000 042 morgen 21 8 square roods — a net increase over the preceding year of 20 514 morgen 490 8 square roods.

Sample plots $\frac{1}{10}$ acre, have been measured of *Eucalyptus resinifera*, *Pinus insignis*, *Rosea lucida*, *Pinus Pinaster* and *Buxus Macowani*, and cultural operations were made with *Pinus canariensis*.

Locally grown timbers used were :

For boxes: *Podocarpus elongata*, *P. Thunbergii*, *P. falcata*, *Pinus insignis*, *Sclerocarya caffra*, *Cussonia umbellata*;

One Morgen = 600 square roods = 2,116 acres

Items	Demarcated		Undemarcated	
	Morgen	Roods	Morgen	Roods
Area on Mar. 31, 1916	727 006 ¹	301	252 520	43 ¹
Additions during report period	3 030 ¹	150	17 751 ¹	140 8
	730 036	451	270 272	270 8
Excisions during report period	267	100 ¹	—	—
	729 769	351	270 272	270 8
Changes from undemarcated to demarcated during report period	17 920	541	17 920	541
Area on Mar. 31, 1917	747 690	292	288 192	320 8

For match factory: *Cuscuta umbellifera*, *C. Spicata*, *Podocarpus fulata*, *P. elongata*, *P. Thunbergii*, *Populus monilifera*;

For railway purposes: *Pinus insignis*, *P. pinaster*, *Podocarpus* sp.;

For police batons: *Milletia cyma*

Experiments were also made in collecting bush tea (*Borbonia* sp.) and in resin-tapping. Tanning materials collected have been: bark of kliphout (*Rhus Thunbergii*), black wattle bark (*Acacia decurrens* var. *mollis*), pods of *Acacia arabica* var. *Kraussiana*. The charcoal produced in the retort is of excellent quality and continues to be in great demand.

The total quantity of Cape boxwood (*Buxus Macarocarpa*) exported during the financial year 1916-17 was 5204 cubic feet, and the average net return was approximately 1s 8d per cubic foot.

LIVE STOCK AND BREEDING

744 - **Destruction of Tetanus Antitoxins by Chemical Agents.** — BERG, W. N. and KESLER, R. A., in the *Journal of Agricultural Research*, Vol. XIII, No. 10, pp. 471-195 + 4 Diagrams + Bibliography of 16 works. Washington, June 2, 1918.

HYGIENE

The aim of these researches was to contribute to the solution of the problem of the chemical nature of antitoxins and their preparation in a pure state, and incidentally to ascertain whether an antitoxin is, or is not, the same thing as a seroprotein. The method used consisted in submitting the antitoxin preparation to the action of artificial digesting reagents and finding, by determining the coagulable protein and the amino-nitrogen, the quantity of antitoxin that remained in the different mixtures. The work primarily concerned the serum of bacterial anthrax, but as the results were not conclusive, most of the work was limited to tetanus serum and tetanus antitoxin. These were treated with solutions of trypsin + sodium carbonate and trypsin + hydrochloric acid for a relatively

long time. The proportion that had been digested was then measured and the remaining toxin was kept for the inoculation of guineapigs.

The authors found that tetanus antitoxin in a 0.5 % solution of sodium carbonate was slowly, but completely, destroyed. At the same time, they did not find any important chemical changes in the proteins. In neutral or solutions faintly acid to litmus paper, trypsin destroys the antitoxin while, at the same time, the associated proteins are destroyed. The quickness with which the antitoxin was destroyed and the protein decomposed was essentially the same. Similar results were obtained with solutions containing trypsin + 0.5 % of sodium carbonate. Tetanus antitoxin in 0.2 % hydrochloric acid was completely destroyed in 3 days or more; during this period, no important chemical changes were observed in the proteins. In neutral solutions, pepsin has no action on the antitoxin. Proteolysis and the destruction of the antitoxin proceed simultaneously in pepsin + hydrochloric acid.

The inference from these results is that the antitoxin is of a non-protein nature. But the stability of the antitoxin depends so much on that of the protein to which it is attached, that when the protein molecule is decomposed, so is the antitoxin.

745 - **The Appearance of Coccidioid Granuloma or Oidiomycosis in Cattle in California.** — JILINER, L. E., in the *Journal of Agricultural Research*, Vol. XIV, No. 12, pp. 533-541 + 2 Plates + Bibliography of 14 works. Washington. September 16, 1918.

The causal agent of coccidioid granuloma was discovered by WERNICKE in 1892; named *Coccidioides immitis* by RIXFORD & GILCHRIST, who considered it as a protozoon, it was classified as a fungus by OPHÜLS and MORFET in 1900. Up to the present, the disease, which is rare and limited to only a few localities, had been observed exclusively in man. The author has found the same disease in the bronchial and mediastinal lymphatic glands of cattle slaughtered at San Diego, California. The parasite isolated from pus from infected glands is the same as the human parasite. The disease has been transmitted experimentally to guinea-pigs, dogs, cattle, sheep and pigs. Infected cattle do not respond to subcutaneous allergic experiments. Neither specific complement-fixing bodies, nor agglutinins can be discovered in the serum of infected animals.

746 - **Researches on the Efficacy of Certain Emulsions for the Protection of Camels against the Attacks of Tabanids, in India.** — CROSS H. L., in the *Agricultural Research Institute, Pusa, Bulletin* No. 76, 11 pp. Calcutta, 1917

The disease known as "surra" (1) is transmitted to camels by tabanids. In fact when healthy animals traverse a region where the disease occurs, if they are protected against the attacks of flies, they do not contract the disease.

On account of this fact, the author has tested the value of several emulsions for the protection of camels against the attack of flies. The chief

(1) Parasitic disease due to infection by *Trypanosoma Evansi*, especially common throughout Asia in Ungulates (Ed.)

emulsions were made up respectively with the following substances as a basis: — kerosene; "tara-nira" oil (*Erucia sativa*); creosol; cod-liver oil; castor oil; oil of citronella; etc. Each test was made on 6 animals, 4 of which were rubbed with the preventive emulsion, 2 serving as controls.

RESULTS. -- The efficacy of the emulsion is temporary, i. e., the flies reappear on the animal after a time, which varies for each emulsion, but is too short (a few hours) for practical use. Only one emulsion, that made from castor oil, was really efficacious. Camels rubbed with it were kept free from flies for 3 days after the application of the treatment, in spite of the abundance of these insects. It should be noted, however, that the high price of castor oil makes its general use in practice almost impossible.

747 - **The Passage of *Trypanosoma berberum* from the Mother to the Foetus in the "Debah".** -- SERGENT ED. and FR. and LHERITIER A., in the *Bulletin de la Société de Pathologie exotique*, Vol. XII, No. 4, pp. 177-178. Paris, April 9, 1919.

The authors have found, at the Pasteur Institute of Algeria, that a gestating camel inoculated with *Trypanosoma berberum* showed fever after 3 days, trypanosomes after 5 days, and aborted on the 13th day. Though the blood of the still born camel calf showed no trypanosomes on microscopical examination, yet it infected a dog inoculated with it intraperitoneally. Another female camel inoculated with *T. berberum* showed fever after the third day, trypanosomes after the 5th day, and aborted on the 64th day. The blood of the still-born camel showed no trypanosomes when examined microscopically but infected two dogs that received intraperitoneal injection of it. These two experiments show that *T. berberum* can pass the placental filter.

748 - **"Lammparalysi" (Paralysis of Lambs), a New Disease of Sheep observed in Sweden.** -- MAGNUSSON, H., in *Landtmannen Tidskrift for Landtman*, Year II, No. 1, pp. 7-8 + 2 Figs. Stockholm, January, 1919.

Of late years a new disease of sheep has been observed in various countries. This disease is characterised by neuromuscular disturbances and is similar to that known as "trembling" ("travarsjuka"). The author proposes to call this new disease "paralysis of lambs"; it differs from that known as "trembling", because it only attacks unweaned lambs. The disease appears from year to year in the same flock.

So far the etiology of the disease is very obscure; post mortem examination reveals no lesions in the medulla or brain. No microorganism that might cause the disease has been discovered, and inoculation tests on healthy animals have given no results. The symptoms of the disease are as follows: — when the lamb is 2 to 3 weeks old it loses control of its hind legs; when it stands up it can hardly walk more than 10 yards or so, when it falls down; after a few minutes, it gets up, walks a few yards, then falls down again so exhausted that it cannot get up again. The paralysis soon spreads to the front legs and if the animal is lifted up by the skin of its back, its legs dangle as if it had no control over them. At

first, the general condition (temperature, appetite and digestion) is normal, but it gradually becomes worse and the animal finally dies of exhaustion. Various remedies, as well as change of food (giving foods rich in matter that assists bone-formation), have been tried, but without avail. The only thing to be done is to slaughter the animal and, as the disease persists from year to year, flocks with affected lambs should be replaced.

As far as is known to the author, the disease has not been studied anywhere in spite of its serious nature. In Peru, where it is known as "renguera" it attacked 10 000 lambs in one year and severe measures have been taken to eradicate the disease, the nature of which it is hoped will soon be revealed by research work.

749 - **The Mode of Infection of Hog Cholera; Researches in the U. S. A.** — DORSET, M., MC. BRYDE, C. N. and BIETZ, J. H., in the *Journal of Agricultural Research*, Vol. XIII, No. 2, pp. 101-131. Washington, April 8, 1918.

Research carried out by the Bureau of Animal Industry of the Department of Agriculture of the United States.

The secretions of the eyes and nose, the blood, urine and faeces of animals suffering from hog cholera were examined the 1st., 2nd., 3rd., 5th., 7th., and 9th. day after infected. On injection, the secretion of the eyes and nose and the matter suspended in the faeces were found to be infectious on the 4th or 5th day; the blood was infectious after the first day. Freshly gathered secretions and excrements when spread in the sties or ingested by the pigs were not infectious. Secretions and excrement kept at the temperature of the air (10 to 18° C) for 24 hours remained infectious on injection. When the secretions and excrements were kept at the same temperature for 38 hours, the urine and faeces remained infectious, but the secretions of the eyes and nose were no longer infectious. But it should not be deduced from this fact that, outside the body, the virus present in the secretions of the eyes and nose dies more rapidly than that present in the urine or faeces, because the virus from these secretions was left to dry on brushes. These experiments, therefore, should be repeated with virus kept under identical conditions. It should be noted that the secretions of the eyes and nose can be infectious before these organs are visibly affected.

Pigs subject to the disease were placed with pigs suffering from the disease for 48-hour periods on the 1st., 2nd., 3rd., 5th., 9th and 11th. day after infection. With the exception of those exposed in this way for the first 48 hours, all the others contracted the disease; the same took place with pigs placed with infected pigs on the 17th. and 21st. day after infection. Consequently, pigs suffering from cholera can transmit the disease by contact, at almost any stage, even in the incubation period, before the appearance of visible symptoms and before the animal could be recognised as ill.

Pigs subject to the disease were placed in sties occupied by pigs that had suffered from typical cholera, but had recovered. Others, also subject to the disease, were inoculated with blood from pigs that had reco-

vered; 4 pigs that had recovered were also tested to see whether they had any cholera virus in their organism and thus could spread the disease. Not one of the pigs living with pigs that had recovered or inoculated with the blood of these latter, contracted cholera. It was found that pigs which, in these experiments, remained unaffected, were susceptible to injections of the virus.

Pigs subject to the disease were exposed for long periods to contact with pigeons that came each day from a sty some 10 ft. away and containing a severely infected herd. Thus the exposure was very great as the pigeons had every chance of carrying the disease across such a short distance. In spite of this, none of the pigs were infected. It was next shown that all the pigs in question were susceptible to the disease transmitted either by injections of virus, by living with infected pigs, or by living in an infected place.

These experiments lasted all the autumn and part of the winter. Although the hypothesis that pigeons might spread hog cholera cannot be absolutely excluded, it is probable that they are not of much importance from this point of view.

Mice were fed for periods of 5 to 21 days with meat from pigs that had died of cholera. The mice were then killed, the whole of their bodies cut up, mixed with bran, and fed to pigs subject to the disease. None of them was infected by cholera. By means of infections of virus, these pigs were shown afterwards to be susceptible to the disease.

750 - **Note on a Filaria observed in the Dutch East Indies in the Conjunctiva of a Fowl.** - SMIT, H. J., in the *Veearfsnykundige Mededeelingen*, No. XXVII, pp. 3-6 + 1. Fig. Batavia, 1918.

The author (of the Veterinary Institute of the Dutch East Indies) records the presence of a filaria in the conjunctiva of a fowl. When the eyelid was rapidly and repeatedly opened and shut, the nematodes could be seen moving rapidly over the eye and taking refuge in the cavity situated under the nictitating membrane.

Macroscopic and microscopic examination led the author to believe that it was either *Filaria mansoni* Cobbold, or a closely related species, for the descriptions by NEVEU-LEMAIRE, FIEBIGER and RAILLET differ somewhat from the morphology of the parasite examined.

NEVEU-LEMAIRE states that this filaria has been recorded from the palpebral cavity of fowls in China, Annam, Mauritius, Jamaica, Florida and Brazil. The life cycle and mode of infection of the parasite are not completely known. The case described by the author from a fowl from Buitenzorg (in the interior of Java) apparently contradicts the statement of previous authors according to whom this filaria is only found near the sea.

751 - **Influence of the Rutting Period on the Fat-Content of Milk.** - DECHAMBRE, P., and GINIEIS, in the *Comptes Rendus des Seances de la Société de Biologie*, Vol. LXXXII, No. 13, pp. 490-492 + 2 Tables. Paris, May 10, 1919.

It is known that the period of rut or ovulation causes modifications of the chemical composition of the milk of dairy cattle. The milk formed

during this period does not keep well, has a more marked taste and smell and may cause gastro-intestinal disturbances in very young children.

The object was to find whether the fat is influenced by the animal being "on heat" and accordingly the authors made use of several cows belonging to the dairy of the School of Agriculture at Grignon. The results of the analyses, expressed in grams of fat per litre of milk were, for example, from one cow: -- evening before coming in season 82; first day in season, morning 50, evening 26; following days morning, 58-52-48-55; evening 81-70-66-67. These results show clearly that the fat-content decreases and also that the phenomenon occurs suddenly and lasts only a short time, for, on milking the next time, the fat content increases and rapidly becomes normal.

Various analyses, however, have shown individual differences. Thus, certain cows are influenced very little, while others apparently do not react at all. Further analyses have shown that these differences are due to the very varying degree of genital stimulation of the females, those that are most stimulated showing the greatest decrease.

FEEDS
AND FEEDING

752 - **The Physiological Basis of Feeding and the Importance of the Ratio Fat: Protein.** — MAIGNON L., in the *Comptes Rendus des Seances de la Societe de Biologie*, Vol. LXXXII, No. 12, pp. 400-401. Paris, May 3, 1919.

In previous experiments, the author had drawn attention to the part played by fats in the utilisation of proteins (1) while his researches considered generally, clearly show that there is a minimum of fat necessary for the economic and non-toxic utilisation of the proteins. The part played by the three organic nutritive principles can be defined as follows:

(1) that of the *proteins*: to provide the nitrogen required to repair the wastage of the tissues;

(2) that of the *fats*: to intervene in the utilisation and assimilation of the proteins;

(3) that of the *carbohydrates*: to provide the energy required to maintain physiological activity.

In other words, a ration for an adult animal should contain:

(1) *the food for wastage*: the amount of protein required to repair the wastage of the tissues;

(2) *the food for nitrogenous utilisation*: the minimum of fat needed to assure the economic and non-toxic utilisation of that protein;

(3) *the food for energy*: a quantity of carbohydrates corresponding to the amount of energy used up in physiological work.

The fat: protein ratio, for this reason, becomes of prime importance in feeding, because it *controls the utilisation of the nitrogen*.

In the natural feeding of young animals — suckling mammals as well as birds in the lactal period — as well as in the meat food of adults, this ratio is equal to 1, or very close to unity.

As the average composition of the milk of domestic mammals is per cent. 4.25 of nitrogenous matter, 4.11 of fat and 6.13 of lactose,

(1) See R., November 1918, No 1196. (Ed.)

partially skimming the milk, as is done in large towns (in France), may have the effect not only of diminishing its food value but also of causing the utilisation of its proteins to become toxic.

In the hen's egg, the proportions of nutritive principles are 12.55 % of nitrogenous matter and 12.11 % of fat.

MAYER and SCHAEFFER have shown, for meat, the existence of a proportion of fatty acids equal, on an average, to 14 % for the sartorial muscle of the dog; this gives 15 or 16 % of fat, while the average quantity of proteins varies around 18 %.

753 - Composition and Digestibility of Sudan-Grass Hay. Investigations in the United States.— GAESSLER, W. G. and MC CANDLISH, A. C., in the *Journal of Agricultural Research*, Vol. XIV, No. 4, pp. 176-185 + 10 Tables + Bibliography of 9 Publications. Washington, July 22, 1918.

After reviewing the work on Sudan grass previously carried out at the numerous experimental stations of the United States, the authors discuss the results of their own studies on the composition and digestibility of Sudan hay. The results themselves are given in table form.

The average yields obtained show that, as a rule, a yield of 1.1 to 5.5 tons per acre of hay (field cured) may be relied on. The averages of all the analyses published by the different stations show the composition of Sudan grass to be as follows: water 6.86 %, dry matter 93.14 %. The dry matter contains: Protein 8.10 %, nitrogen-free extract 49.41 %, fibre 33.92 %, ether extract 1.89 %, ash 6.70 %. The analyses published are fairly uniform, except with regard to the protein and minerals. The variations in these constituents are very marked and may, perhaps, be attributed to environment and to the stage of development of the grass at the time of cutting. It should, however, be noted that, from the time Sudan grass flowers till the time it is fully ripe there is very little variation in the fibre content of the dry matter and, consequently, cutting may be delayed without any danger of the fodder's becoming too hard. This is a great advantage in years when it rains at harvest time.

Up to the present the Maryland Agricultural Station has made but one digestion experiment with Sudan grass. The following coefficients of digestibility were obtained: dry matter 60.6 %, crude protein 35.4 %, nitrogen-free extract 63.3 %, fibre 67.1 %, ether extract 41.2 %.

At the Kansas Agricultural Station Sudan hay was compared with alfalfa as a roughage for dairy cows. During two thirty-day periods the cows fed on Sudan grass yielded slightly less milk (4.022 lb. per cow daily) than the others. This difference would, however, have increased had the experiment been prolonged. Moreover, the cows fed alfalfa hay gained 24 lb. per head more than the others throughout the experiment.

Observations made at the Kansas Experiment Station showed that, when a herd of dairy cows was moved from natural pasture to Sudan grass pasture the average daily milk yield increased by 3.2 lb. per head. Sudan grass is much inferior to alfalfa hay as a winter food for draught horses and mules and young oxen.

The authors analysed the 1915 Sudan grass harvest at various stages of development. The results obtained are given below.

	Before the formation of the in- florescence	At the time of the formation of the in- florescence	Full flowering	Half ripe	Ripe
	%	%	%	%	%
Total dry matter	20.80	20.96	25.74	30.08	31.92
<i>Composition of the dry matter :</i>					
Protein	8.80	9.78	6.57	5.02	4.29
Nitrogen-free extract	48.12	46.04	50.19	53.32	53.73
Fibre	32.98	35.50	32.36	32.96	33.83
Ether extract	2.31	2.62	3.53	2.10	1.66
Minerals	7.79	6.06	7.35	6.58	6.40

As is seen, the composition of the dry matter of Sudan grass changes little from the time of flowering till it is ripe. The fat and protein contents increase during the first stages of ripening and then decrease, whereas the changes in the nitrogen-free extract and minerals occur in the opposite sense. The relative proportion of fibre was higher in the dry matter while the inflorescence was forming than when the grass was ripe.

A digestion experiment lasting five days (preceded by a preliminary period of seven days) during which only Sudan hay was fed to two heifers, gave the following average coefficients of digestibility: - dry matter 64.9 %, protein 47.4 %, nitrogen-free extract 67.8 %, fibre 70.6 %, ether extract 58.4 %. These results show the food elements of Sudan grass to be fairly well digested and that it is more suitable as a source of energy than as a source of protein for cattle. The net energy value per 100 lb. of dry matter is 142.36 calories

754 - **Comparative Toxicity of Cottonseed Products.** WITHERS, W. A. and CARRUTH, F. E., in the *Journal of Agricultural Research*, Vol. XIV, No. 10, pp. 125-45. + 15 Tables + 5 Figs + Bibliography of 16 Publications. Washington, September 2, 1918.

Many cottonseed products (seeds in their natural state, seeds extracted with ether, gossypol, and various cottonseed meals) have been fed to rats, rabbits, hens, and pigs. Seeds in their natural state and the gossypol extracted from them proved very toxic to all these animals. Boiling the seed, as is done in oil factories, greatly decreases the toxicity. So marked is the effect that well-cooked products have no pronounced poisonous action on rats and poultry when administered in suitable diets. The boiled meals, however, appear absolutely injurious to rabbits and pigs, which are particularly susceptible to this form of poisoning, but rats and poultry can withstand much larger relative quantities of meal for a much longer period. When the cottonseed oil is extracted by pressure in the cold

large quantities of the toxic substances pass into the oil, so that the meal is much less toxic than that obtained by pressure in heat.

Except for a certain decrease in laying, excessive quantities of cottonseed cake do not appear very injurious to hens. The presence of unmodified gossypol in the diet may cause a peculiar discoloration of the yolk.

Pigs were subjected to various diets with the object of comparing the effect of cottonseed cake with that of other similar concentrated protein foods, such as peanut meal, soybean meal, and cottonseed extracted with ether. Attempts were made to eliminate the toxicity by adding to well-cooked cottonseed cake either meat scraps, calcium lactate, sodium chloride, and butter fat, or 10 % of skim milk powder as supplements. Improving the ration by the addition of good foods does not inhibit the injurious action of cottonseed meal on pigs. This injurious action is not produced by similar foods. The poisoning of pigs fed on cotton-seed meal is, therefore, due to the presence of a toxic substance, not to a defective diet. The authors believe this toxic substance to be a gossypol derivative which they have named D-gossypol.

755 - **Dried Crickets as a Food for Stock, in Uruguay.** — See No. 690 of this Review.

756 - **Breeds of Light Horses, in the United States.** — REESE, H. H. in the *United States Department of Agriculture, Farmers' Bulletin* No. 952, 10 pp. + 10 Pigs. Washington, June, 1918.

HORSES

Detailed information is given of breeds of light horses best suited to mountain or hilly country or where there is great demand for saddle or light draught horses.

The breeds described are: - Arab, Thoroughbred, Standard-bred, American saddle, Morgan, Hackney, French Coach (the military horse produced in France, largely with State aid, and known in that country as half-bred), German Coach (name given to various breeds of horses produced in Germany for the army, and more especially for the artillery), and Cleveland Bay.

The principal light breeds bred in the United States are the Standard-bred, American Saddle, and Morgan.

757 - **Digestion of Starch by the Young Calf.** — SHAW, R. H., WOODWARD, T. E., and NORTON, R. P., in the *Journal of Agricultural Research*, Vol. XII, No. 9, pp. 575-578 — 2 Tables + 1 Fig. Washington, March 4, 1918.

CATTLE

The aim of the authors was to determine the age at which calves begin to be able to digest and assimilate starch and starchy foods. EWING and WELLS, in their work on this subject, found that if twelve-month old calves are fed a ration composed of maize silage, cotton-seed meal and starch amounting to 47.3 % of the total net energy of the ration, the iodine test does not show the presence of starch in the faeces. F. KRÜGER (*Die Verdauungsfermente beim Embryo und Neugeborenen*, Wiesbaden, 1891), in his work on embryo and new-born calves found that the salivary glands secreted ptyaline as early as the seventh month of the life of the foetus. Although the quantity of ptyaline secreted gradually increases till birth, it is still too slight at this last period to play any part, however small, in digestion.

The authors took as subjects two four-day old calves. These were given at each meal 40 grm. of ordinary maize starch mixed with milk for three days. They were then given whole milk only for five days, then milk and starch for three, and so on, till one of the animals was 39 days old and the other 31.

At the age of four to seven days one of the animals digested 22.02 and the other 20.3 % of the starch eaten. When the first was from twelve to fifteen days old the percentage of starch digested had more than doubled, at three weeks it had almost tripled, and at four weeks exceeded 90 %. At the age of three weeks the second calf could already digest more than 90 % of the starch taken. It is probable that a calf a few hours old is incapable of digesting any appreciable quantity of starch. These experiments, however, showed that the quantity of enzymes capable of decomposing starch must increase very rapidly during the first days of life because, already at an age of three or four weeks, the subjects could digest a ration containing starch in amounts equal to 10 % of the total dry matter. The milk ration of a calf a few days old may, therefore, be supplemented by a starchy food, the quantity of which may be rapidly increased as the animal grows older.

756 - **Banana Stems as a Food for Cattle, in India.** — *Department of Agriculture, Bombay, Leaflet No 1 of 1919, 2 pp*

Among the foods used for cattle in times of food shortage mention has never been made of banana stalks although banana leaves, which are used as dishes, are sometimes given to animals after having been put to this purpose.

Experiments made in certain villages of the Belgaum district show that banana leaves, stalks, and roots may be fed to stock without any unfavourable effect on their health. Once the harvest is gathered the stalks are usually cut down to about 6 inches above the ground, thrown in a heap and left to waste. It would be much better to cut them right down to the ground, or even 6 inches below the surface of the soil, remove all the dry leaves and sheathes, and feed the remaining part to animals. Buffaloes accept this food at once, cattle sometimes refuse it at first. Experiments made on the Dharwar and Gokak farms show that one of the daily meals of draught oxen may consist solely of banana stalks.

Hindoo farmers generally consider that this food when given to oxen acts as a purgative. This is, however, quite a mistake; the faeces of animals consuming as much as 38 lb. of banana stalks daily were found to be as solid as those of animals fed on straw and hay only.

SHEEP

759 - **Digestibility of Sulphite Pulp by Sheep; Researches in Norway.** — ISAACHSEN H. in the 11te *Beretning* (1916-1917) *fra Forsøgs forsøkene ved Norges Landbrukskole*, pp. 24-35 + 10 Tables. Cristiania, 1918.

The Norwegian High School of Agriculture has organised feeding experiments in order to ascertain the digestibility of sulphite pulp (obtained industrially by boiling finely chopped fir wood under pressure in a solution of calcium sulphite) which is used in Scandinavia as a cattle food.

The coefficient of digestibility of the sulphite pulp (= cellulose) was determined by feeding two sheep successively with the following rations per day and per head: — (1) a basal ration of chopped hay (630 gm.) + wheat offals (90 gm.) + fish meal (90 gm.) — (2) a ration composed of hay (350 gm.) + wheat offals (50 gm.) + fish meal (50 gm.) + finely powdered sulphite pulp (300 gm.) — (3) a ration composed of hay (350 gm.) + wheat offals (50 gm.) + fish meal (50 gm.) + lumps of sulphite pulp broken up by hand ("smaastykker") (200 gm.) + sulphite pulp coarsely ground in a machine (100 gm.)

The following coefficients of digestibility were found for the powdered cellulose and that in lumps respectively: — Dry organic matter, 90 and 79; Crude fibre, 95 and 91; Nitrogen-free extract, 81 and 32; Total carbohydrates, 94 and 86.

It will be seen that sulphite pulp can be compared as regards its digestibility with hay and the most digestible natural foods; again, there is no marked difference between the digestibility of finely powdered pulp and that in lumps. The quantity of fixed protein, expressed in gm. per day and as percentage of the protein digested, is as great in the case of the cellulose in lumps as in that of the finely powdered pulp; the second form has no advantage over the first from this point of view. The quantity of unfixed nitrogen present in the excreta in the pepsinic form ("tærnikvoelstof" or "pepsinford ielig eggehvite") was also determined by feeding the animals first with the basal ration alone, then with the ration containing powdered pulp, then with the ration containing the cellulose in lumps. It was found that the quantity of pepsinic nitrogen that was not fixed during the period of feeding with the basal ration and during the period of feeding with powdered pulp was, respectively, 0.48 gm. and 0.5 gm. per 100 gm. of digestible dry matter, which corresponds to 2.97 and 3.12 gm. of protein. During the period when lump pulp was fed, this quantity was 0.35 gm., which corresponds to 2.21 gm. of protein.

During the period when sulphite pulp was fed, the two sheep received an average of 28 gm. of digestible crude protein per day, while they assimilated from 6.2 to 10.7 gm. of protein per day, corresponding to 20-50 gm. of meat. The maintenance ration of sheep is usually calculated to be 100 gm. of protein per 100 kg. of live weight; the preceding experiments, carried out during winter, have shown that, in Norway, during winter, sheep can be maintained on a smaller ration than the normal one, reckoning that the average live weight of the two animals was 35 kg., and that they only received 28 gm. of digestible crude protein per day, instead of the 35 gm. based on the usual figures for the maintenance ration (100 gm. per 100 kg. of live weight).

760 — **The Utilisation of Irrigated Field Crops for Hog Pasturing.** — FARREL, F. D., in the *U. S. Department of Agriculture, Bulletin No. 752*, 37 pp. + 20 Tables + 6 Figs. Washington, April 24, 1919.

PIGS

Most of the data published on the value of extensively grown crops used for the production of pork are based on results obtained in non-irrigated districts and cannot always be satisfactorily applied to the con-

ditions prevailing in irrigated districts. This is particularly true of crops grazed by pigs. Since 1912 the U. S. Department of Agriculture has made experiments and observations on the utilisation of irrigated crops as pasture for pigs. The results are given of investigations made with 3 795 pigs divided into 149 lots. Of these 89 lots grazed alfalfa, and the others sweet clover, maize, field peas, and milo.

It was found that grazing pigs on alfalfa is a very satisfactory way of utilising this plant and one of the most economical methods of producing pork. To obtain satisfactory results with alfalfa pasture some food containing carbohydrates should be given as a supplement. If maize, barley, milo, wheat, or shorts be added at the rate of 2 % of the total ration, 1 acre of good alfalfa pasture will yield 2500 lb. live weight in a year. In experiments in which 3 % of maize was given as a supplement, as much as 4492 lb. per acre was obtained. The gain made with alfalfa pasture depends on the size of the plant, the type of pig, the method of breeding, and the quantity and quality of the supplementary food given. Alfalfa pasture without a supplementary food cannot be recommended.

Pigs grazing alfalfa with a supplement of about 2 % of maize, barley, wheat, milo or shorts, consume approximately 250 to 300 lb. of grain per 100 lb. of gain. As a rule the amount of grain required per pound gained increases with the size of the pig and with the proportion of grain distributed. The food value of maize, barley, milo and shorts as a supplement to alfalfa pasture differs so little that the choice of these supplements should depend on their price, suitability for cultivation, and the economic conditions. When the breeder grows the supplementary grain himself preference should be given to maize, barley, or sorghum according to the conditions and locality.

One acre of good alfalfa pasture with a grain supplement equal to 2 % of the total ration will, on an average, support 2500 lb. of growing pigs. The carrying capacity increases rapidly with an increase in the grain ration. It varies a little during the period the animals are growing with the rate of growth of the alfalfa. One acre of good alfalfa pasture with a supplement of 2 % of maize or barley will support 6 to 8 sows and 50 to 70 spring-born suckling pigs for approximately 60 days at the beginning of summer. During this period the young pigs should gain from 25 to 30 lb. each. At the end of this period the young pigs should be able to graze the alfalfa alone until fully grown.

The few tests which have as yet been carried out show that sweet clover cannot be compared with alfalfa as a pasture for pigs. This plant is only of real use to pig breeders in soils which are too wet or too salt for alfalfa.

The method of letting pigs graze maize fodder and field peas on irrigated land is advantageous because it saves labour, produces satisfactory gains, and adds manure to the soil.

In the experiments described the gains made with maize pasture varied from 183 to 1 048 lb. per acre without a supplementary food, and from 335 to 1 377 lb per acre with a supplement. An average of 450 lb.

of maize fodder was required to produce 100 lb. of gain when no supplementary food was given as compared with 409 lb. when tankage or late alfalfa or rape pasture was given as a supplement. When breeding in an irrigated district, alfalfa pasture is the best supplement to maize fodder because of its cheapness and reliability.

The experiments described show field peas to be a very valuable irrigated crop as a pasture for pigs. In seventeen tests the gains per acre varied from 250 to 949 lb., the average being 500 lb. These results easily bear comparison with those obtained with maize pasture if the selling price of these plants be considered. It should, however, not be forgotten that in certain districts where maize grows well field peas do not do so well as in other colder districts where maize grows less satisfactorily. Field peas are particularly suitable as pasture for pigs when ordinary grains are dear and it is desired to find a substitute for them.

Horse beans have been successfully used in some irrigated districts but this crop is still considered as being yet in the experimental stage as an irrigated crop in general. This plant appears particularly sensitive to certain fungoid diseases.

Sorghum and, more especially milo, is occasionally used in the South Western States as pasture for pigs. Its principal value for the production of pork lies, however, in the usefulness of the grain as a supplement to alfalfa pasture and as a finishing ration. When used for this purpose the cracked or ground grain is considered to have a higher food value than when eaten whole as is the case when it is grazed.

761 - **Keeping down the Costs of Pork Production.** - HAYS, F. A. (Delaware Experiment Station), in *The Brecker's Gazette*, Vol. LXXV, No. 10, p. 534-535. Chicago, March 6, 1919.

A test was undertaken by the Delaware Experiment Station to determine as accurately as possible the cost of a pig at weaning time when 60 days old. The experiment began on Nov. 1, 1917, and covered a period of 180 days, closing on April 29, 1918. Twelve Berkshire sows and one Yorkshire sow were mated to a Yorkshire boar. These sows had been running on clover pasture with a limited grain allowance previously to Nov. 1 and were not carrying much flesh. After Nov. 1 they were fed corn at the rate of 1 1/2 per cent of the weight of the sows, wheat middlings and bran mixed in equal parts and supplied in a self-feeder, and tankage fed in another self-feeder. This ration was continued until Dec. 15, or for a period of 45 days. At this date middlings were omitted as the sows were getting rather fat, and bran alone was fed with no other change in ration. On Jan. 1 the corn was reduced to about 1 per cent of the body weight of the sows. On Jan. 31 corn and cob meal was substituted for bran in the self-feeder, and this together with tankage self-fed was supplied to all sows until shortly before farrowing.

A few days before due to farrow each sow was removed to a community hoghouse and fed a thin slop of bran, middlings and tankage, with but little corn. As soon as each sow was on feed after farrowing she re-

ceived all the thick slop, made of 30 parts middlings, 15 parts bran, and 5 parts tankage, that she could consume while suckling her litter for 60 days. In addition to the slop each sow received about 2 per cent of her body weight in ear corn during the suckling period and plenty of water. When her pigs were weaned each sow was returned to the original lot and fed as before farrowing.

At the age of one month all the young pigs were given access to hominy feed and oil meal, each self fed, and after weaning they received the same amount and kind of slop that their dams had while suckling them. All were given the simultaneous treatment for cholera at 60 days.

The sows made an average daily gain for the six month's period of 0.33 lb. They consumed on an average 2.8 lbs of grain per 100 lbs live weight during the six months. They consumed as low as 2 per cent of the body weight in grain daily, while at maximum milk production the consumption often was as high as 4 per cent of their body weight. It was found both economical and desirable to feed the sows to their maximum consumption while suckling the pigs for sixty days. The cost of gains in the pigs was greatly reduced through this system of feeding.

The average number of pigs farrowed per sow was 9.9; the average birth weight of pigs was 2.47 lbs; the average weight per pig on April 29 was 29.57 lbs; the average daily gain per pig was 0.46 lb. and the average number of pigs raised per sow farrowing was 6.6. The average amount of grain eaten daily per pig was 0.15 lb and the grain required per 100 lbs gain was 30.1 lbs. The cost of grain per 100 lbs gain of pigs was 82 cents. When we consider the advantage in increased gains that may be secured by using a creep we are forced to admit that a very small amount of grain produced wonderful results in these pigs.

The interest on the investment was figured at 5 percent for the six-month period. Charge for the simultaneous treatment was \$2. A shelter charge of 25 cents per sow was made and a boar service fee of \$1 per sow. The labour charge per sow was \$3.75 and the estimated value of the manure \$8. The average total expense per pig weighing 29.57 lbs at 65.3 days old was \$3.93. The feed prices used are those current at the time of working on the experiment, and they represent war-time prices.

The conclusions may be drawn from this experiment that the cost of producing a pig at weaning time depends upon two main factors: first, the average number of pigs raised per sow, and second the feed cost of sow and pigs. By selecting prolific females and flushing them at breeding time the first cost item may be greatly reduced. By buying feeds in quantity, using forage crops, using a self-feeder, and feeding an entirely complete ration liberally the second cost can be kept down.

POULTRY

762 - **Mineral Content of Southern Poultry Feeds and Mineral Requirement of Growing Fowls.** -- KAUPP, B. F. in the *Journal of Agricultural Research*, Vol. XIV, No. 3, pp. 125-134, + 8 Tables + 1 Plate. Washington, July 15, 1918.

The object of the experiments described was:

1) To determine the quantity of minerals per unit of live weight in the body of chickens and in that of fowls weighing 1 ½ lb.

2) To determine the mineral content of the foodstuffs given to poultry in the Southern States. (Estimations were made of the mineral content of bolted maize flour, pinhead oats, rolled oats, whole wheat, whole maize, wheat middlings, bone meal, velvet bean meal (*Mucuna pruriens* var. *utilis*), soybean meal, peanut meal, skimmed milk, eggs with the shells, green rape, limestone grit, oyster shells).

3) To find a food mixture containing satisfactory proportions of protein, carbohydrates, and fats. (The following mixtures expressed in parts by weight were used in the experiments: rolled oats 8 + wheat middlings 8 + meat and bone meal 2 + bone meal 1; cracked wheat 3 + cracked maize 2 + pinhead oats 1; wheat middlings 6 + maize meal 3 + meat and bone meal 3 + bone meal 1; whole wheat 2 + cracked maize 2 + hulled oats 1).

4) To determine the mineral content of this mixture.

5) To determine by means of feeding tests whether the minerals contained in the food mixtures are present in sufficiently large quantities to cause the highest possible rate of growth.

The mineral content of the body of fowls, the mineral content of the foods used, and the quantity of minerals eaten, voided, and metabolised by the young fowls throughout the experiment, are set out in a series of tables.

The mineral content of the foods varied, for each foodstuff in the different lots. This variation depends on weather conditions, the soil, etc.

To produce 1 grm. of gain, 7.49 grm. of milk 2.91 grm. of mash and grain mixture and 1 grm. of green foodstuff were required. On an average the young fowls digested 75.2 % of the carbohydrates and 80.2 % of the fats. The calcium, magnesium, sulphur, and phosphorus requirement of the chicken increased gradually as it grew older. To supply a satisfactory quantity of these elements to chickens fed on a mixture of waste or milling by-products, such as middlings and pinhead oats, either meat and bone meal, bone meal, or meat meal must be added. Sour skim milk and butter milk, if administered in sufficiently large quantities, will supply the requisite minerals and food hormones.

763 - **The Use of Mussels as a Food for Poultry in Denmark.** — SIENBOECK, N. M. T., in the *Ugeskrift for Landmænd*, Year 64, No. 13, p. 178. Copenhagen, March 24, 1919.

In Denmark, owing to the lack of grain, mussels have been utilised as food for poultry (1). They are prepared in the following way: -- the mussels are boiled, washed, dried, then reduced to meal. This mussel meal ("mushingeniel") will keep a long time.

This food was analysed at the School of Agriculture at Døstrup with the following results: — Moisture 3 to 4 %; Proteins, 8 to 10 %; Fats, 1 to 2 %; Other organic matter, 13 to 14 %; Mineral constituents (especially carbonate of lime), about 75 %.

(1) Mussels have already been used in Denmark for feeding pigs. See *R.*, September, 1918, No. 1017 (*Ed.*)

Feeding experiments, in which the fowls were fed in alternating periods of 14 days, with and without "mussel meal", gave the following relative values as regards egg production: *Period I* (without mussel meal) $1 \frac{1}{3}$ — *Period II* (with mussel meal) $4 \frac{1}{12}$ — *Period III* (without) $1 \frac{1}{2}$ — *Period IV* (with) $3 \frac{1}{2}$ — *Period V* (without) $\frac{3}{7}$. At first they did not take to the food readily and had to become gradually accustomed to it. The author advises that mussel meal should be introduced at the rate of $\frac{1}{3}$ of the ration.

Mussels occur abundantly along the coast in the fjords; they now cost 40 øre the kg (about 2.3 d. per lb.) and consequently furnish a good food from the economic point of view, considering the present high prices.

764 — **Winter Cycle of Egg Production in the Rhode Island Red Breed of Domestic Fowl** (1), in **Massachusetts, U. S. A.** — GOODALE, H. E., in the *Journal of Agricultural Research*, Vol. XII, No. 9, pp. 547-574 + 14 Tables + Bibliography of 7 Publications. Washington, March 4, 1918.

The winter period of egg production is one of the internal factors influencing the determination of the total production; PEARL and SURFACE discovered this in Barred Plymouth Rock hens. They found that there is a natural sequence of periods in fertility; the winter period, from November to February inclusive, is characterised by a rapid increase in the average production together with an equally rapid decrease in both the absolute and relative variability. At this period fertility is an addition, derived from domestication and forced laying, to the natural laying period of wild hens. It is distinctly limited, beginning at the commencement of the laying year and ending with the rest which occurs between it and the beginning of the spring period of fertility.

The author analysed by the biometrical method the daily fertility records of three flocks of Rhode Island Red Hens born in 1913, 1915, and 1916 respectively. He compared these with the monthly laying records of White Wyandottes and Barred Plymouth Rocks made at the Maine Agricultural Station (GOWELL, *Breeding for Egg Production, Maine Agricultural Experiment Station Bulletin*, No. 79, 1902, and No. 93, 1903). GOWELL's data confirm the hypothesis of PEARL and SURFACE and that of PEARL with regard to the existence of a winter period of fertility. The author found this period to be much more marked in the fowls of the Maine Agricultural Station than in those of the Massachusetts Station examined by him. The winter period of fertility of the last lot, Rhode Island Reds, could be determined only for a part of each run.

As regards a winter period of fertility in the individual the author concludes that: 1) the rate of production as deduced from the monthly record is not sufficient proof of the existence of a winter period of fertility in Rhode Island Red hens; 2) the best proof of the existence of a winter period in the individual is the pause in production which occurs during one or more of the winter months and usually lasts ten days at least;

(1) See also R. Feb., 1916, No. 208. (Ed.)

this pause follows on a period of continuous production; 3) in some cases an interruption of ten days, or even less, occurring in February and March and following on a period of several weeks' continuous laying, may mark the end of the winter period of fertility. When the winter pause could be determined with a certain accuracy, no correlation was found between the number of eggs laid before the pause and the duration of the pause.

The author's observations show that inclination to winter fertility is hereditary. It has, however, not yet been determined in what way it is so.

765 - *Crotalaria usaramoensis* as a Honey-Yielding Plant, in the Dutch East Indies. — See No. 729 of this Review.

BEE KEEPING

766 - Wild "Kurimushi" Silkworms and the Foundation of a Spinning-Mill to utilise their Silk, in Japan. — *Bulletin de l'Association sericole du Japon*, Year III, No. 3, p. 18. Tokio, January 5, 1919.

SERICULTURE

The wild "Kurimushi" silkworms occur almost exclusively in Japan and Corea. Their cocoon, of a brownish colour and oval shape, greatly hardened by abundance of sericine cannot be wound by the ordinary method. The silk, though exported in small quantities, has fetched quite good prices.

This silk has not been exported since the beginning of the war. As the cocoons have accumulated in the stores at Yokohama, an improved method of winding them has been sought, and Mr. SAITO, Professor at the Higher Industrial School of Tokio was asked to investigate the problem.

These researches have led to the discovery of a satisfactory method of winding these extremely gummy cocoons, of degumming and bleaching the silk and using it for making a fine silk cloth.

A company has just been founded under the name of Nippon Kenjū-Boshoku-Kaisha for the purpose of establishing a spinning mill for this wild silk, containing several thousand spindles and gradually developing the industry up to weaving silk cloth. The capital is said to be 3 million yen (about £ 300 000) and the promoters are said to be industrial leaders and traders from Tokio and Yokohama.

767 - *Goussia truttae*, a New Species of Coccid parasitic on the Native Trout, in France. — LIGIER, L. and HESSI, F., in the *Comptes rendus de l'Académie des Sciences*, Vol. CLXVIII No. 18, pp 904 906. Paris, May 5, 1919

FISH CULTURE

So far, few coccids are recorded as parasites on freshwater fish and not one is known on the Salmonidae. All the coccids that have been described from fish are remarkably uniform and belong to the octozoic tetrastorous Eimeridae. LAUBI has divided them into two chief genera, the genus *Goussia* and the genus *Coccidium* (= *Eimeria*).

The author reports that he has discovered a coccid on wild trout (*Salmo fario*) from a stream near Grenoble (Isère). He places it in the genus *Goussia* under the name of *Goussia truttae* n. sp.

The fish examined were nearly all infected with parasites. They were on an average, 20 cm. long and were not affected pathologically. The

parasites, however, were numerous in the epithelium of the pyloric caecum and the beginning of the small intestine.

The author describes the new species and gives a diagnosis of the disease.

FARM ENGINEERING

AGRICULTURAL MACHINERY AND IMPLEMENTS

798 - **Mechanical Cultivation of Vineyards: Trials at Montpellier (France) (1); Citroën Tractor.** — DESSAIX-AIX, R., in the *Journal d'Agriculture pratique*, Year LXXXIII, New Series, Vol. XXXII, No. 17, pp. 347-349 + 2 Figs. Paris, May 29, 1919.

The trials at Montpellier, organised by the "Société centrale d'Agriculture de l'Hérault", took place on May 2, 3 and 4 in vineyards belonging to the "Plaine" and "Bouet" farms.

Out of the 14 makers who entered, only 7, with 9 machines, took part in the trials, they can be classified in the following way —

Tractors with driving wheels: ANDRÉ CITROËN, 143, quai de Javel, Paris — B. CHAPRON, 45, rue de la République, Puteaux (Seine) — DESSAIX-AIX, entered by the Sud-Automobile Co., boulevard St.-Roch, Avignon (Vaucluse).

Chain-truck tractors: CLEVELAND, presented by the Allied-Machinery Co., 19, rue de Rocroy, Paris — A. W. PIDWELL (Lightfoot tractor), 19, boulevard Malesherbes, Paris.

Front driving wheel tractor: MOINE PLOUGH Co., 159bis, quai Valmy, Paris.

MOTOR WHEEL-BARROW TYPE: PIDWELL (Universal), already mentioned.

Rotary cultivator: "Société d'outillage mécanique et d'usinage d'artillerie (S. O. M. U. A.), 19, avenue de la Gare, St.-Ouen (Seine); two machines.

All these machines have been recorded or described, except the first one, which made its first appearance at these trials.

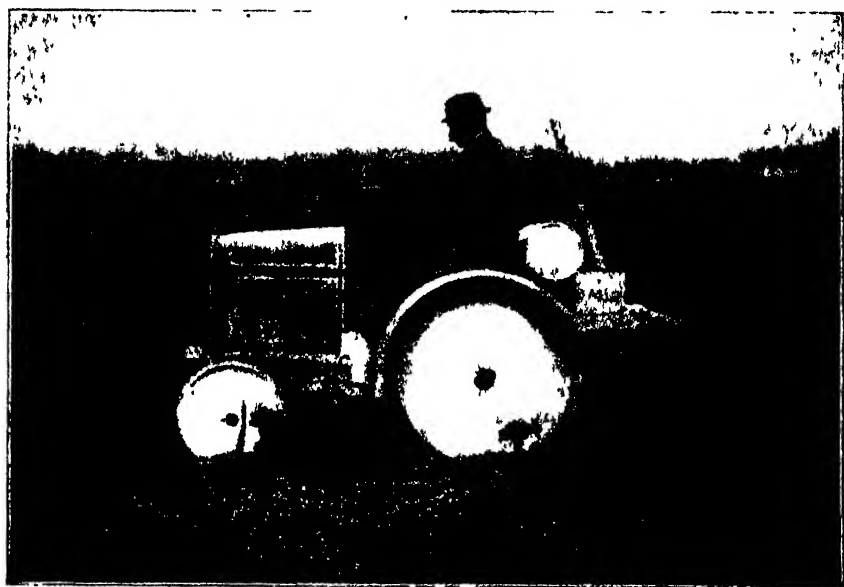
The CITROËN tractor shown in the appended figure, is driven by an engine with 4 vertical cylinders, of 65 mm. bore and 100 mm. stroke, which develops 12 H.P. when running at 1600 revolutions per minute. The speed of the engine can be controlled by means of a governor, which keeps it running at between 400 and 1600 revolutions per minute, but the speed for ordinary work is limited to 1,300 revolutions per minute. The governor has been arranged for the use of the motor when driving machinery by a pulley; to do this, a pulley is placed in front and serves to hold the starting handle. Lubrication is automatic, being effected by an oil pump whose working is shown by a manometer. Cooling is by a thermosiphon and fan, for when moving forward slowly or when driving fixed machinery, there is sufficient air to cool the radiator properly. The two forward speeds give 3500 and 4800 metres per hour, while the reverse gives about 3000 metres per hour.

(1) See R November 1918, No. 1267. (Fd.)

In turning, which can easily be done in a radius of 2 metres, independent brakes lock the driving wheel on the side of the turning centre. The front axle, mounted on a transverse spring, is articulated vertically so that it can assume a very oblique position relatively to the back axle. The wheels are 55 and 90 cm. in diameter; the weight of the tractor in working order is 840 kg., and its very reduced dimensions are: width, 86 cm.; length, 250 cm.; height, 150 cm. It is so small that it can pass between vines planted in lines 150 cm. apart. Its sale price is 9500 francs.

The CITROËN tractor can give, at a speed of 3000 metres per hour, an average pull under practical condition of 425 to 430 kg., which is more than sufficient to haul the machinery required for cultivating vineyards.

On the road, with its tyres held up by strakes fastened on by nuts, its pull under practical conditions is 300 kg.



CITROËN tractor

The CHAPRON tractor is driven by an 18 H. P. engine; it weighs 1300 kg. and costs 13 000 francs.

The DESSAULT'S tractor has its driving wheels arranged one behind the other; the transverse balance is provided for by two bearing wheels attached to the frame by uprights and a cross-beam passing over the rows of vines, which are 150 cm. apart.

The CLEVELAND tractor has a 24 H.P. motor; it is 127 cm. broad.

The LIGHTFOOT tractor has a 4 cylinder 7 H.P. motor; it is 110 cm broad

The MOLINE front-wheel tractor is driven by a 17 H.P. motor.

The "Universal" motor wheel barrow machine, 90 cm. broad and guided by a man holding the slits, has a 4 to 5 H.P. motor; consequently, it can only do light work at a walking pace.

The machines entered by the S. O. M. U. A. are a large 35 H.P. model, and a small 5 H.P. model of the motor wheel-barrow type; the former works on a width of 2 metres, the latter on a width of 60 cm.

The MOLINE front-wheel tractor and the large model of the S.O.M.U.A. are intended for plantations having a distance of more than 2 $\frac{1}{2}$ metres between the rows.

The Citroen and Chapron tractors have been made in accordance with the conclusions of a report by M. RINGELMANN published in the *Journal d'Agriculture pratique*, No. 26, of December 27, 1917, p. 503.

769 - **Review of Patents.** — Sources: GERMANY, *Patentberichte* 1919, *Beilage der Zeitschrift "Die Chemische Industrie"* Leipzig. — CANADA, UNITED STATES, NEW ZEALAND, UNITED KINGDOM, SWITZERLAND, see R, January, 1919, No. 104 — CUBA, *Boletín oficial de Marcas y Patentes*, Secretaría de Agricultura, Comercio y Trabajo, Havana — FRANCE, see R, February, 1919, No. 247 — INDIA, see R, May 19 9, No. 630

TILLAGE MACHINES AND IMPLEMENTS — *Canada* 189406 Hoe cultivator; 189781 Motor plough; 189928 Plough, 189959-192078 Tractor plough, 190356 Gang plough

France 490702 Brabant plough; 490703 Improvement for Brabant ploughs; 490736-490737 Brabant ploughs in which the angle of the plough body can be regulated.

Switzerland: 81079 Rotary hoe with spades

United Kingdom: 123697 Improvements to motor ploughs; 124002 Haulage drum for motor ploughs, 124013 Device for regulating the height of the frame of a motor multiple balance plough, 124059 Device for helping the tipping movement of a balance plough at the end of the furrow; 124076-124079 Device for lifting the working parts of disc ploughs, 124272 Tractor for ploughing, 124599 Device for attaching ploughs, cultivators, etc., to a tractor

United States: 1296777 Rotary harrow, 1297117 Plough for pulverising the soil, 1297123 Disc harrow, 1297182 Stalk-cutting plough; 1297377-1297594-1297909 Ploughs, 1297516 Rotary plough, 1297908 1298329 1298870 Motor ploughs, 1298385 Accessory roller for gang plough, 1298735 Spring tine harrow, 1298760 Drill, 1299044 Gang plough, 1299064 Cultivator.

IRRIGATION — *Canada* 189994 Irrigation apparatus

MANURES AND MANURE DISTRIBUTORS — *Canada*: 189600 Process for manufacturing calcium nitrate (by inoculating nitrogen-fixing bacteria in a nutrient solution containing calcium carbonate, calcium nitrate and ammonium sulphate, the final liquid, containing calcium nitrate, is divided into two parts, from one of which the salt is extracted, the remaining part serving to restart the process, which is continuous, after the necessary additions have been made, 189601 Process for manufacturing calcium nitrate (by treating a porous mass of calcium carbonate first

with a solution of calcium nitrate containing nitrifying bacteria, then with a dilute solution of the nitrogen compound that is to be nitrified; finally, compressed air is blown through the porous mass); 189602 Process for manufacturing nitrates (by adding to the ammoniacal compounds that are to be nitrified a nutrient medium containing nitrifying bacteria as well as a substance harmless to these bacteria but which can destroy others that might harm them); 189603 Process for making calcium nitrate (by placing a well-aerated solution of cyanamide and calcium nitrate in intimate contact with nitrifying bacteria; continuous process as described above under patent No. 189600); 189604 Process for oxidising ammonia (by passing a solution of ammonium chloride through a thin alkaline layer containing nitrifying bacteria in the presence of air); 189921 Organic manure obtained by strongly aerating liquid sewage in the presence of bacteria; 190123 Manure and seed drill.

France: 490944. The agglomeration of superphosphate and manures derived from it in the form of briquettes, balls, etc., so that bags are not required in transporting them.

Germany: 298200 Process for making a manure from calcium cyanamide but free from dust and easy to spread (by mixing the cyanamide with dry peat soaked with saline solutions); 309668 Process for making an ammonium nitrate with little hygroscopicity (by evaporating at a low temperature solutions containing both ammonium nitrate and potassium chloride).

New Zealand: 41155 Seed and manure drill.

Switzerland: 81400 Manure distributor.

United Kingdom: 10595 Process for making calcium nitrate by a double reaction between calcium chloride and ammonium nitrate; 123912 Apparatus for the manufacture of superphosphates.

United States: 1298651 Feed control for manure distributors.

DRILLS AND SEEDING MACHINES. - *Canada*: 189052 Discs for drills; 190123 Seed and manure drill.

France: 490617 Combined drill and manure distributor; 490689 Combined hoe and drill.

New Zealand: 41155 Seed and manure drill.

United Kingdom: 123610-124379 Potato planters.

United States: 1297601 Planter with wheels for compressing the soil; 1297863 Planter; 1298259-1298483 Maize planters; 1298756 Potato planter; 1299160 Disc drill.

VARIOUS CULTURAL OPERATIONS. - *Canada*: 189406 Cultivator; 190268 Lawn clippers.

France: 490689 Combined hoe and planter.

United Kingdom: 123862 Hoe for a team or tractor.

United States: 1296840 Plough for earthing-up potatoes.

CONTROL OF DISEASES AND PESTS OF PLANTS. - *France*: 490315 Improvements to processes for disinfecting and for destroying parasites; 490536 Improvements to machines for dusting fruit trees, etc.; 490773 Spraying plant for traction.

New Zealand : 41307 Apparatus for destroying wild rabbits.

United States : 1297933 Plough for destroying the cotton-boll-weevil.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada* : 189341 Sharpener for mower blade.

Cuba : 3261 Sugar-cane harvester.

France : 490960 Improvements to mowers ; 491006 Hand mower with motor.

Switzerland : 81401 Hay tedder ; 81402 Apparatus for hammering scythes ; 81569 Hay rake.

United States : 1297867 Bean harvester ; 1297950 Header for cereals.

MACHINES FOR LIFTING ROOT CROPS. — *United States* : 1297231-1297298-1298708 Beet harvester ; 1297666 Beet topper ; 1298169 Potato harvester.

THRESHING AND WINNOWER MACHINES. — *Canada* : 190093 Grain cleaner ; 190283 Screen.

United States : 1297349 Grain harvester and cleaner ; 1299341 Screen.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *France* : 490714 Improvements to trussing machines.

Switzerland : 81403 Device for compressing sweet green silage.

United Kingdom : 123610 Waterproof cover for shocks.

United States : 1296641 Shock loader ; 1296889-1297450 Hay-press ; 1297852 Portable elevator-stacker for cereals.

FORESTRY. — *Canada* : 189725 Brush-cutter.

Switzerland : 81571 Tree-felling machine.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada* : 190239 Tractor.

New Zealand : 41159 Device for attaching agricultural machinery to a tractor.

United Kingdom : 124002 Haulage drum for keeping automobile agricultural machines at a constant speed ; 124023 Improvements to tractors ; 124272 Tractor, 124590 Device for attaching ploughs, cultivators, etc., to a tractor.

United States : 1297154-1297291-1298127-1298262-1298781-1298986-1298989-1299178-1299190 Tractors ; 1298247 Wind engine.

BEE KEEPING. — *New Zealand* : 41211 Honey extractor.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada* : 189662 Fruit dryer ; 189834 Machine for cutting the tips of bean pods ; 190070 Instrument for removing the core from apples ; 190131 Power-driven circular saw mounted on an automobile.

India : 4005 Power-driven defibrator.

New Zealand : 41248 Defibrator.

DAIRYING — *Canada* : 189658 Milk bottle ; 189701 Milking machine.

New Zealand : 41313 Automatic apparatus for measuring milk ; 41324 Milking machine.

VARIOUS. — *Canada* : 190137 Harness attachment ; 190169 Fly trap.

770 - **Type of Silo used in Sweden for Storing Potatoes.** — *Kungl. Landbruks-Akademiens Handlingar och Tidskrift*, Year 57, Nos. 7-8, pp. 522-523 + 1 Fig. Stockholm, 1918.

(On account of the food shortage and the need for preserving the chief foods in the best possible way, a description is given of a cheap and practical potato silo which is used in the south of Sweden. It is something between a cellar and an ordinary silo. A ditch, 30 cm. deep and 2 ½ metres wide is dug; stakes are stuck in of such a height that the roof clears the potatoes, an air space of about 30 cm. being left between the potatoes and the roof. The roof consists of a layer of planks lying on the supports, the planks being covered successively with a layer, 10 cm. thick, of straw or dry leaves, a layer of earth 30 cm. thick, a second layer of straw or dry leaves 10 cm. thick, and finally with a layer of earth 20 cm. thick. In the side of the silo one or two doors, situated at the same level, are made, which can be opened in fine weather.

This device, which unites the advantages of the cellar with those of the ordinary temporary silo, can also be used for the storage of roots.

RURAL ECONOMICS.

771 - **Farm Management.** — BOSS ANDRIW (Minnesota College of Agriculture) in *Howd's Dairyman* Vol. LVII, n. 9 pp. 426 and 462 Port Atkinson, Wis., March 21, 1919

The writer confines himself to discussing, four or five factors which have proved to be very important in securing profits from farming. These factors have been discovered through farm management investigations made in Rice County, Minnesota, and supplemented by information gained from investigation in other States. These investigations point out clearly the fact that among the most important factors in making the farm pay are: (1) the wise use of capital, (2) the efficient use of labour, (3) high yields of crops, and (4) large production from live stock.

The wise use of capital. - Every farmer should recognize the fact that the capital invested in his farm should be expected to earn at least as much interest for him, as money deposited in a savings bank. A farmer who invests his money in a farm simply chooses the farm as offering an opportunity for better returns than would the same money return if deposited in a savings bank, or invested in a farm mortgage, and it is just as much his business to see that it earns five or six or ten per cent, as it is for any man investing money in other lines of business, to see that it earns a good rate of interest. One of the most effective ways in which to make capital earn interest is to correctly proportion the amount of capital that goes into operating forms. Statistical data covering this point seem to indicate that from 25 to 33 per cent of the total capital available should be used as operating capital. If used for the purchase of good live stock, for the purchase of suitable machinery, for the employment of labour, and for the purchase of feeds and other material, with which to keep the farm going, it will be in the safest form of operating capital.

On well equipped dairy farms and especially where pure-bred stock is kept the proportion of capital, in forms for operating, may run as high as 40 per cent, with excellent results.

One starting in the farming business should borrow money on the real estate and invest it in operating expense, first for the reason that it can be borrowed at a lower rate of interest on real estate ; and second, because if ready cash is available more stock and equipment is likely to be purchased. With available capital for buying and selling and for making a quick turn-over when opportunity offers, the farmer, if good judgment is used, has many opportunities for making gains on his investment.

Efficient use of labour. — On every farm there is a certain amount of labour which must be used on non productive enterprises. On some farms this may run as high as 42 per cent. On well diversified farms, and especially on dairy farms, it may run even as low as 26 per cent. On highly specialized farms it may run even as low as 20 to 22 per cent. Obviously where 80 per cent of the labour is expended on productive enterprises, such as heavy yielding dairy cows, quickly fattened hogs and large yielding crops, the returns are bound to be larger than where only 60 per cent of the labour is used for that purpose. No one would deny that when a person works by the hour his total compensation is greatest when he works a large number of productive hours. In the same way the farmer who works a large number of hours at productive labour can expect large returns from his effort. Investigations in Minnesota indicate that 3000 hours is a good average year's work for a farm hand or farmer. This means ten hours a day for 300 days in a year. Some farmers will contend that they work more than that, but records kept of their time indicate that they work less rather than more. Farms on which all of the farm hands work an average of 3000 hours each, paid a very much better rate of income than those on which the farm hands work an average of 2000 hours. Some farms were found where the average number of hours of work per year was only 1500. Of course these men received very low returns on their farms because they actually did only half a year's work. Three thousand hours of work per year per man, 80 per cent of which or 2400 hours, per year spent on productive enterprises, is a large factor in securing large returns from the farm.

Large crop yields. — People in a general way know that large yields of crops are a desirable thing. That is why farmers try to settle on good land. The importance of large yields has been clearly brought out in farm management surveys. On any farm where the yields are higher than the average for the community, the labour income of the farmer is found to be comparatively high. It can hardly be otherwise because the farmers of a community usually all sell on the same market and for approximately the same price. Therefore the one who has the most to sell is likely to have the largest returns. The cost of growing large crops is very little more than that of growing an average or a lower than average crop. Consequently any increase in yields over the average is almost clear gain.

High production from live stock. — Students of dairying have told us that cows giving less than 225 pounds of butterfat were merely boarders

on our hands. With the present high prices of feed it is doubtful whether they are not still boarding when they give as much as 250 pounds of butterfat. The cost of maintaining a cow that gives 250 pounds of butterfat is almost as great as the cost of maintaining a cow that gives 350 or 400 pounds of butterfat. Obviously the profit from higher producing cows is very much greater. There is no way in which a farmer can lose the profit from his crops so quickly as by feeding them to low producing cows or other live stock. It is just as important that crops be fed to quick growing or rapidly fattening meat animals, as it is that they be fed to high producing ones. That is the only way in which profit can be made on the manufacture of feeds into meat products. Young animals well fed from birth and raised on a good quality of farm roughage and rapidly fattened on reasonable amounts of grain feed, offer an almost certain source of profit and give good returns for labour employed in that way.

These four points may be set down as the cardinal ones in making a farm pay. There are said to be 196 other points and all have an influence on returns from farming. More of them undoubtedly will become accepted principles of farm management, but none will, we feel sure prove to be more important than the ones just discussed.

772 - **The Value of Records to the Farmer.** — BALL, J. S., in the *Yearbook of the U. S. A. Department of Agriculture*, 1917, pp. 153-167. Washington, 1918.

The author proposes to show the practical advantages that farmers would derive from a careful examination of the accounts of the farm and household, by contrasting them with the results obtained by keeping accounts in a way that is still often taught.

The author insists that it is of vital importance for the farmer to have a clear understanding as to just what facts about the farm business should be shown by the records. In default of this understanding little benefit will be obtained by keeping accounts.

• **USEFULNESS OF ACCOUNTS.** — To be of practical value, they should contain all the daily events of the farm which are worth recording, so that when required they can be found easily.

SIMPLE ACCOUNTS. — Farm accounts may be roughly divided under two heads: — a) Records of happenings; b) Records of money transactions. As examples under the first head the author gives: — the date when a cow calves or when a sow farrows, when animals are bred, when men are hired or discharged, when the pasture season begins or ends, when the first and last frosts occur, when the incubators are set, the date of seed time, harvest, etc. Such notes as these, when systematically recorded and constantly referred to, are of much value. In fact they help the farmer to a better adjustment of the farm work in its cycle. Records of money transactions, though admittedly useful, are not always utilised in such a way as to yield the greatest amount of information, for the reason that they are often not examined analytically, though the information obtained from such an examination is of the greatest use to the farmer.

The year's record of the cash received and paid out can be assembled

under practical heads that will show exactly what branch of the farm is most productive and what each branch requires to keep it going. Again the relative importance (as %) of each branch of the farm business can be seen. The year's cash summary is easily prepared and would be very useful to small farmers who use very little hired labour and work the farm themselves with the help of their family. For this type of farmer, labour expenditure is at a minimum and the value of the cash summary will be all the greater from the elimination of this item.

The utility of any particular branch of the farm activities cannot be deduced definitively from a summary examination of the cash transactions, in using such records as an aid to future plans, hasty conclusions must not be drawn, and any opinion must be formed cautiously. Comparison of the annual figures year by year is another source of profit from the use of accounts, since by such comparison, a true perspective and insight into the make-up of the business is gained.

The cash account may be kept in any convenient form, but perhaps the simplest and most interesting way, which, moreover, gives a more personal touch, is to keep a diary. Any information wanted at the end of the year may be assembled from a diary account book in a few hours; the author gives examples of this.

USES OF AN ANNUAL INVENTORY. The diary account book described above, although it is very useful, cannot be used in any true system of accounting with an inventory. It is well worth the trouble for the farmer who keeps a diary account book to make an annual inventory. The uses of the inventory are important and varied. Taken alone it shows a farmer exactly what he is worth and will be a guarantee of solvency and an aid to securing credits and loans from the bank. The inventories for two dates a year apart show whether progress or retrogression has occurred during the year and definitely measure the degree of the change. Taken in conjunction with a cash account for the year, the inventory shows how much has been made by farming and to what extent the personal and household expenses have offset profits. An example is given showing how the inventory totals and cash account may be utilised to show the profit made by the farm.

COST RECORDS AND THEIR PRACTICAL IMPORTANCE. — After having briefly considered the utility of the simplest ways of recording the various events of a farm, the author deals with the value and usefulness of cost records, the aim of which is to show the costs of each branch of the farm and the income each has produced and, eventually, the general costs, although these latter can hardly be separated in anything but a more or less arbitrary fashion. However, this difficulty, though theoretically insurmountable, does not affect the great comparative value of the other records of costs and their relative yields, which form, on the contrary, a faithful reconstruction of the actual facts. The analytical record of labour thus shows its distribution throughout the year between the different crops, and gives precise information as to how many hours of man or animal labour were required for each acre and as to the exact period of the year when these

hours were required. This simple record of the work required by the different crops that form the cultural combination makes it possible to deduce conclusions of great practical importance as regards any changes that might be introduced into the combination of crops, either by eliminating certain crops, by introducing others, or by modifying the areas they cover. The cost records for forage furnish data of great practical importance relating to all the kinds of live stock kept on the farm. In this way, suitable provision can be made, not only for the forage required for the livestock combination of the farm, but also for the forage required for any livestock combination that it might be desirable to introduce later, using as basis a comparative study of the forage consumption and yield of each class of livestock.

By developing these cost records systematically, cost prices can be obtained for a unit area which, if not of absolute value when considered alone, are of great comparative value, especially if the comparison is established from a series of years. As an example, the author gives the appended cost record for potatoes.

These tables of unit costs per acre for each crop are of double value, due, in the first case, to the fact that they show the costs spread over a series of years, and in the second case, because they show up the more, by a systematic control, the data of facts (which may be described as physical) that are inherent to the different crops and which, unlike unit prices of means of production and yields, vary little from year to year; again they are, perhaps, of greater practical importance to the farmer than the idea of cost thus obtained. The classification of the sections dealing with the quantities and qualities relating to the labour of men and animals, seeds, fertilisers, yields of different crops, etc., is of prime practical importance because it forms the best source of information for a close analysis of the organisation of the farm. (*see table pag. 732*).

The author advises that the unit cash records should be examined very carefully before drawing conclusions from them for the reorganisation of the farm so as to yield greater profits. The interdependence of the different factors of production in the complex organisation of the farm should never be lost sight of, otherwise it might happen that the suppression of a crop or of a branch of the farm's activity, eliminated because its analytical record was closed with a loss, might lead, under a final analysis, to a greater loss than that which the projected suppression was intended to avoid. For this reason, changes in the organisation of the farm should be introduced gradually, while carefully watching the effects they produce in relation to the other forms of activity of the farm. And to do this, there is nothing better than cost records which, properly used, form a solid basis and excellent guidance for the solution of the complex problem of the organisation and re-organisation of the farm.

The author closes his paper by pointing out the importance of keeping household accounts, especially in determining how much the farm supplies to his house. The farmer often does not think of what his farm provides him, yet he may have been living much better than the average city man of

like education, attainments and capital. All these things can only be sown by a well-kept set of records.

Detail of the cost of growing potatoes on a western New York farm for a series of five years

	1910	1911	1912	1913	1914	5 year average
Acres grown	0.5	17.2	0.7	19.3	0.167	18.88
Costs per acre —						
Cost of manual labour for growing	\$ 7.61	\$ 7.36	\$ 7.82	\$ 8.10	\$ 5.78	\$ 7.33
Cost of horse	10.67	8.50	9.65	8.41	6.76	8.80
Cost of manual labour in harvesting	5.41	5.29	4.36	4.22	4.93	4.85
Cost of horse	4.15	4.92	3.74	1.20	3.17	3.94
Total labour cost in growing	18.28	15.86	17.47	16.51	12.54	16.13
Total labour cost in harvesting	10.11	10.21	8.10	7.42	8.10	8.79
Total costs per acre	28.39	26.07	25.57	23.93	20.64	24.92
Materials used						
Manure	6	9.13	9.00	1.3	8.59	6.14
Seed potatoes	0	1.18	17.78	8.16	10.57	9.36
Fertilisers	5.13	13.10	9.14	10.32	10.04	10.15
Time for spraying	4.1	4.1	4.1	5.4	1.5	4.0
Arsenate of lead for spraying	1.70	1.40	1.1	1.34	1.20	1.36
Sulphate of copper	1.18	.97	.53	3.45	2.43	2.57
Total cost of materials	17.75	34.19	40.66	25.06	33.04	30.02
Indirect costs						
Implement cost	4.30	7.10	8.37	6.50	8.13	6.91
Interest and taxes	.96	1.75	3.57	5.43	5.40	4.22
Overhead expense	3.30	5.23	6.99	4.87	5.70	5.14
Total indirect cost	10.65	16.08	18.53	16.80	19.23	16.26
Total cost per acre	56.79	76.34	84.16	65.79	72.91	71.20
Cost per bushel						
Labour to grow	0.09	0.08	0.08	0.10	0.06	0.08
Labour to harvest	0.05	0.05	0.04	0.04	0.04	0.04
Materials	0.09	0.16	0.19	0.15	0.15	0.1
Indirect cost	0.05	0.08	0.09	0.10	0.09	0.08
Total cost per bushel	\$ 0.28	\$ 0.37	\$ 0.40	\$ 0.39	\$ 0.34	\$ 0.32
Yield per acre	bushels	201	208	168	217	200.6
Selling price per bushel	\$	0.40	0.55	0.49	0.60	0.46
Seed per acre	bushels	12.8	14.5	15.5	16.1	14.6
Seed cost per bushel	\$	0.25	0.49	1.15	0.51	0.63
Fertiliser per acre	lb	643	87	200	767	739
Hours per hour per acre						
Man labour	\$	0.153	0.141	0.156	0.171	0.15
Horse labour	\$	0.177	0.143	0.148	0.120	0.14
Man hour per acre						
To grow		49.74	52.22	50.08	47.37	46.7
To harvest		35.68	37.55	27.95	24.72	31.6
Total		85.42	89.77	78.03	72.09	77.2
Horse hours per acre						
To grow		60.28	59.46	65.15	70.08	61.4
To harvest		26.29	34.40	25.27	26.63	27
Total		86.57	93.86	90.42	96.71	88.1

AGRICULTURAL INDUSTRIES.

INDUSTRIES
DEPENDING
ON PLANT
PRODUCTS

773 - **Banana Flour and its Substitutes** (1). — I. EATON, B. J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 10, pp. 430-436. Kuala Lumpur, July-August, 1918. — II. ODDERA, H., in the *Bulletin a rirole de l'Institut scientifique de Saigon*. Year 1, No 4 pp. 123-124 Saigon, April, 1910.

I. — The food value of banana flour is shown in the following table which gives the results of analyses made by the author in England in 1906. These analyses are compared with those made for wheat, barley, maize, and millet.

Constituents of the different flours	Banana flour		Wheat	Barley	Rice	Maize	Millet
	Sample No 1	Sample No 2	flour	flour	flour	flour	flour
	%	%	%	%	%	%	%
Water	9.60	12.06	10.5	15.06	11.11	12.5	11.26
Fat	0.30	0.14	1.2	1.71	0.51	3.6	3.56
Protein (nitrogen = N × 6.25)	3.00	4.80	12.0	11.75	6.91	9.5	11.29
Fibre	0.70	0.70	—	0.11	0.08	2.0	1.25
Carbohydrates (starch, etc.)	83.51	71.87	69.6	10.90	77.61	70.7	66.15
Sugar (glucose)	0.91	1.81	—	—	—	—	1.18
Ash	1.81	2.29	0.7	0.17	0.15	1.7	2.31
Phosphoric acid	0.13	0.17	—	—	—	—	—

The author discusses successively the preparation of banana flour and of other flours made from tropical starch products (sweet potatoes, yam-yams, cassava, etc.), the bread-making from sweet potatoes, the preservation of sweet potatoes, vegetation of fruit, etc. Notes on the cultivation of the banana are also given.

II. — The banana question is examined from the Indo-Chinese point of view. In Cochinchina the varieties of bananas giving a good quality of flour are those known as "banane pomme" ("apple banana") and those called by the Annamites "su" and "sung tran". The last-named variety produces fruit which is remarkable for its size, but it rapidly exhausts the soil. After the second crop the product decreases and eventually becomes insignificant. The fruit of the "bananes pommes" and "su" are only medium as compared with those of the "sung tran" variety, but the total weight of the first two crops is greater. In red soils these plants give very fine yields for several years without any kind of fertiliser. There is no doubt that rational cultivation would give excellent crops.

Directions are given for the preparation of various kinds of cakes, biscuits and tarts with banana flour.

(1) For the food value of the banana see R. Nov., 1918, No. 1198. (Ed.)

be broken and the points should not penetrate into the orange. A good worker can obtain 1250 gm. of oil from 1200 oranges. The oranges should not be completely ripe or the oil will be too dark coloured. The oranges should be gathered and treated in the early morning as the yield decreases when the fruit is gathered during the hot part of the day.

**INDUSTRIES
DEPENDING
ON ANIMAL
PRODUCTS**

777 - **Researches on the Acidity of Milk and Whey in Holland.** — VAN DAM, W., in the *Verslagen van Landbouwkundige Onderzoekingen der Rykslandbouwproefstations*, No. XXII, pp. 1-21 + 18 Tables + 1 fig. The Hague, 1918.

When sterilised milk is inoculated with a pure lactic ferment culture and kept at such a temperature that the ferments will grow, lactic acid is formed, part being neutralised by the compounds in the milk. If the process continues, the degree of acidity gets so high that it prevents the growth of the ferments and thus puts an end to the formation of lactic acid. The same thing happens with whey. Investigators have found that the quantity of base required to neutralise the acid milk is always greater than that required to neutralise the acid whey and several came to the conclusion that the acidity of the former is greater than that of the latter.

But the estimation of a liquid like milk does not always furnish scrupulously exact data. In fact the degree of acidity depends on the hydrogen-ion content. Thus, the addition of a base leads to the neutralisation of the hydrogen-ions by the hydroxyl ions and, finally, to an excess of hydroxyl-ions which acts on the indicator used in titrating the milk. If fresh milk (i. e., in which no lactic fermentation has begun) is compared from this point of view with water, it will be found that (although these two liquids have very similar hydroxyl-ion contents), using 100 cc. of each of these liquids, one drop of $N/10$ base suffices to change the colour of the indicator in the case of water, while 15 to 20 cc. are required for milk. This is because milk contains casein, phosphates and albuminoid matter that fix the hydroxyl-ions.

It is evident, therefore, that the quantity of base used in estimating milk does not express the exact value of its acidity. The same applies to whey, compared with milk. In fact, the whey is deprived of its casein and consequently contains a smaller quantity of matter capable of fixing hydroxyl-ions. In estimating the acidity of milk and whey, the figures obtained are therefore relative. The author estimated the acidity by measuring the hydrogen ion concentration, which expresses the true degree of acidity, and he gives the figures obtained for milk and whey, and compares them with those obtained in the ordinary way. While the differences between the values that express the acidity of milk and whey remain, the values obtained by measuring the hydrogen-ion concentration (expressing the true degree of acidity) of milk and whey show much smaller differences between themselves.

As milk and whey reach approximately the same degree of acidity, it may be suggested that the hydrogen-ions put a stop to the lactic fermentation at a given moment. The author's researches, however, tend to show

that the concentration of the undissociated molecules of lactic acid is equally responsible for the stoppage of the lactic fermentation; this, then, is stopped either by the concentration of these undissociated molecules, or by the concentration of the hydrogen-ions, provided that one or other of these two concentrations has first reached the respective degree at which it becomes fatal to the lactic fermentation, which, of course, depends on the composition of the medium.

778 - **A Study of the Streptococci concerned in Cheese Ripening.** — EVANS, A. C., in the *Journal of Agricultural Research*, Vol. XIII, No. 4, pp. 235-252 + 4 Tables + Bibliography of 23 Publications. Washington, April 22, 1918.

Generally streptococci may be divided into three groups: 1) pathogenic streptococci, which differ in their virulence, and elective capacity for certain organs, as well as in certain bio-chemical reactions; 2) the ordinary streptococci of the udder, the intestines, and saliva, which, in so far as is known, differ from the first group principally in their lack of virulence; 3) *Streptococcus lactis*, which makes milk sour. The author studied streptococci from another point of view, viz; 4) as producers of substances giving special flavours and as agents of other changes taking place in foods prepared with the aid of fermentation, and particularly in the ripening of cheese.

The streptococci belonging to these four groups differ so little from each other that the question has arisen whether they are not really varieties of one species. As a rule, however, several species are recognised. The streptococcus which is active during the ripening of cheese is *S. lactis*. Nevertheless several workers have isolated from different cheeses many varieties resembling *S. lactis* in all points except in their behaviour in lactic cultures. To distinguish these varieties from *S. lactis* the author calls them "cheese streptococci".

Cheese streptococci are usually found in soft or hard cheeses, of various types and classes during the process of ripening, as well as in other foods prepared by fermentation (in the mash with which the Japanese sauce known as "soya" is prepared, in the Chinese soybean cheese known as "tofu"). A study of the streptococci of the mouth, faeces and udder would probably show them to belong to the same type as the cheese streptococci.

The author gives a cultural and bio-chemical description of *S. lactis* and two other species, one of which he names temporarily *Streptococcus X*; the other is identical with FREUDENRICH'S *Streptococcus b*, called *S. Kefir* by MIGUA. The most marked biological characteristic which distinguishes the other two species of streptococci described from *S. lactis* is the small quantity of acetic acid produced by them in lactic cultures. *S. Kefir* is well known in the dairying industry for its large production of carbon dioxide in suitable media.

The author proved experimentally that cheese streptococci modify appreciably the flavour of cheese prepared with pasteurised milk. *Streptococcus X*, *S. Kefir*, and another hitherto unclassified strain of streptococci, improved the flavour and hastened the softening of Cheddar cheese made

with pasteurised milk. *Streptococcus X* and *S. Kefir* also gave a peculiar special flavour to soft cream cheese prepared with pasteurised milk.

779 - **Bacterial Flora of Roquefort Cheese.** — EVANS, A. C., in the *Journal of Agricultural Research*, Vol. XIII, No. 4, pp. 225-233 + 2 Tables + Bibliography of 8 Publications, Washington, April 22, 1918.

The investigations described were carried out in the Dairy Division of the U. S. Bureau of Animal Industry with a view to determining whether cheese made in France from ewe's milk according to the Roquefort process differed much in its bacterial flora from cheese made in the United States by a similar method but from cow's milk.

A study of the bacterial flora of Roquefort cheese both imported and made experimentally showed that the micro-organisms essential to the preparation and ripening of Roquefort cheese are *Streptococcus lacticus* and *Penicillium Roqueforti*. The first decomposes the lactose during the preparation of the cheese, thus producing the lactic acid necessary to its formation. These micro-organisms subsequently disappear after two or three weeks, being killed by the strong sodium chloride concentration. The rest of the bacterial flora is composed of cheese streptococci and *Bact. bulgaricum*, micro-organisms present in all varieties of ripening cheese. These bacteria play no essential part in the ripening of Roquefort cheese. The slime contains characteristic types of micrococci, rods, and yeast cells. The diastases of the slime do not appear to be essential to the ripening of cheese. The flora of the curd and that of the slime of the cheese prepared experimentally were identical with the flora of the curd and that of the slime of the cheese prepared in France respectively. If the manufacturer of Roquefort cheese inoculates his product with suitable quantities of *S. lacticus* and *P. Roqueforti*, and realises the necessary conditions of preparation and ripening, he need pay no further attention to the biological agents of ripening.

780 - **Influence of Humidity upon the Strength and the Elasticity of Wool Fibre.** — HARDY, J. T., in the *Journal of Agricultural Research*, Vol. XIV, No. 8, pp. 285-295 + 4 Tables + 2 Figs. + 1 Plate. Bibliography of 8 Publications. Washington, August 19, 1918.

Though it has been known for many years that wool absorbs the moisture of the air, the first investigations into this subject were made in 1893 by SCHLOESING, who studied the ratio between the moisture content of clean wool and the atmospheric moisture. The results he obtained were fully confirmed by HARTSHORNE in 1905. It was HARTSHORNE who formulated the "laws of regain (by the absorption of moisture) in cotton and worsted". Taking these as a basis he drew up tables showing the moisture content of wool for a large series of variations in the moisture conditions and temperature of the air. These tables show the great sensitiveness with which wool replies to changes in the relative moisture of the air, and by their means it is easy to find the moisture content of wool when the relative moisture of the air is known.

The effect of moisture on the strength and elongation of wool yarns and fabrics was studied by BARKER, BARBRICK and PICKLES who, in their study on worsted, found that when the moisture content passed from absolute dryness to saturation there was a decrease in the strength but an increase in the elongation percentage. They also found that when similar types of wool were tested in a room with 92 % of moisture, then in another with 76 % the strength was increased and the elongation decreased. They further discovered that the strength and elongation coefficient of yarns and fabrics made of cotton increased with the moisture of the surrounding atmosphere.

LEWIS made experiments with wool yarns and worsted similar to those of BARKER and his collaborators under controlled conditions of moisture and temperature, using five different percentages of moisture (from 45 to 85 %). He found an increase of 16 % in the tensile strength of cotton and a decrease of 18 % in the tensile strength of worsted for a 40 % rise in the relative moisture of the air.

Investigations made in 1911 at the Wyoming Agricultural Station under the direction of HILL showed that the dry fibre of wool is stronger than the wet fibre, and that at a moisture content of approximately 15 % wool fibre is stronger than at 35 %.

The author continued these investigations working under temperature and moisture conditions controlled automatically by means of electric connections between a thermograph and a hygrograph indicator working a series of lamps and two water atomisers respectively. He worked at a temperature of 70° F. and 40, 50, 60, 70, and 80 %, of relative moisture. The results obtained for the breaking coefficient, tensile strength, diameter and elasticity of the wool fibres at different degrees of moisture are set out in a table. Briefly summarised they are as follows —

The determination of the breaking coefficient as a measure of the strength of wool does not give satisfactory results on account of the great variations in the size of each fibre. It has not been possible to fix a correction for the diameter of the fibres microscopically. On the other hand, a micrometer put in the place of the lower jaw of the testing apparatus proved an excellent means of making this correction and reducing the breaking strength to the tensile strength, or unit stress. A comparison between the tensile strength at five degrees of relative moisture (40, 50, 60, 70 and 80 %) showed the tensile strength of the raw wool of four different breeds of sheep to decrease with the rise in humidity.

781 — **Experiments on the Preservation of Potatoes by Drying in an Oven used for Stoving Silk Cocoons.** LISSONI, S., in *L' Agricoltura Italiana Illustrata*, Year I, No. 3, pp. 57-58. Milan, March 5, 1919.

FENOGLIO BROS., of Cuneo (Piedmont), proprietors of an oven used for stoving cocoons, which, save for the short silk-worm season, remains idle for the greater part of the year, as do the store-houses, have used the oven for drying potatoes. The potatoes were peeled, sliced, placed in baskets plunged into water containing 1 % of sulphuric acid, then into a 3 % so-

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PACKING,
TRANSPORT,
TRADE

lution of common salt, and finally rinsed in pure water. They were allowed to drain, then placed in fresh baskets ; these were placed in the cocoon oven, heated to 50-60° C, where they were left (a few hours) until completely dry.

The potatoes treated in this way were in white slices with a good appearance; 100 lb. of whole potatoes yielded 92 lb. of peeled, sliced potatoes and 34 lb. of dried potatoes. The dried potatoes can be cooked by boiling for an hour, when they retain their natural flavour. The author thinks that a lower drying temperature — 50-50° C — should be used, never going above 60° C, in order to avoid coagulating the albumen and to have a more tender product that cooks more quickly.

782 - **Storage of Potatoes in Silos in Sweden.** — See No. 770 of this *Review*.

783 - **Storage of Wheat: the Function of Respiration.** — See No. 707 of this *Review*.

DISEASES OF PLANTS

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- 784 - **Intumescences, with a note on Mechanical Injury as a Cause of their Development.** - WOLF, F. A., in the *Journal of Agricultural Research*, Vol. XIII, No. 4, pp. 253-259 + 1 Fig + 2 Plates Washington, April 22, 1918.

During the first half of June 1917, a storm of such velocity that it uprooted tree of considerable size aged round Raleigh, North Carolina. A few days later, when visiting the sandy soils to the east of the town, the author noticed that the leaf surface of cabbage (*Brassica oleracea* f. *cabitata*), and especially the lowest leaves and the tips of the inner leaves, were covered with numerous growths distributed irregularly. In shape they varied from hemispherical to short cylindrical, and in colour from yellowish to greyish. Sometime, these growths were merely points, at others they had a diameter of 3 mm. In extreme cases the growth was twice as thick as the leaf of the cabbage.

These growths were believed to result from lesions produced by the sand driven by the wind. Later this supposition was confirmed by the results of experiments, made both in the open and under glass, in which sand was projected violently against normal cabbage plants. The growths produced were identical in appearance and structure with these found naturally. It was not possible to produce these growths on the ripe parts of the plants, but only on the actively growing tissues. It was observed later that the moisture and freshness of the tissues influenced the development of the growths.

This appears to be the first time that lesions of mechanical origin have been reported as causing the formation of growths on vegetable organisms. The immediate cause of the injuries is believed to be some absorption phenomenon and is due to an increase in the hydration capacity of the cellular colloids resulting from acids produced by oxidation.

- 785 - **An Immune Variety of Sugar Cane.** TOWNSEND, C. O., in *Science*, N. S., Vol. XLIX, n. 1272, pp. 470-472 Lancaster, Pa., May 16, 1919.

In August, 1918, Prof. R. S. HARRIS was commissioned by the U. S. Department of Agriculture to undertake, in collaboration with institutes at Porto Rico, investigations and studies on the mosaic or mottling disease which seriously attacks sugar cane in the island. He observed that among approximately twenty varieties of cane grown at the Federal Station of Mayaguez there was one, the Japanese variety "Kavangire", which

showed no trace of mosaic, whereas all the others were more or less seriously attacked.

To carry out the research more thoroughly a cultivation test was started on October 1, 1918, on the Santa Rita estate belonging to Russell and Co. Ninety varieties of cane were so arranged that every three rows there was one row occupied by diseased plants of the "Rayada" (ribbon) variety. In this way every variety was uniformly and completely exposed to the infection.

Two and a half months later, Mr. H. BOURNE, the cane planting expert, observed that all the varieties, with the exception of Kavangire, were attacked by mosaic disease, the infection varying from 9 to 96 %. The Kavangire variety remained free from the disease up till March, 1919, and from all the signs observed appeared immune to it.

On January 20, 1919, Prof. FARLE observed that approximately half of the varieties used in the experiment were infected in the proportion of 100 % and that in only two cases was the infection as low as 50 %. Other varieties also were seriously infected. Very few showed slight traces of infection, thus proving that, if not entirely immune, they were at least resistant. Kavangire was the only variety which remained completely free from attack. Observations made at Mayaguez as well as in other localities showed it to remain immune both when young and when fully ripe.

This variety grows very high and has very thin stems. Porto Rico growers, however, prefer a thick cane because it seems to give a better yield and demand less labour. Nevertheless, under certain conditions, the yield of Kavangire compares favourably with that of other varieties and, in some cases, even exceeds it largely. There are no analyses available of this variety under the cultural conditions of Porto Rico, but, according to examinations made in other districts, its sugar content varies from 14.38 to 16.85 %, and its purity coefficient from 84.6 to 89.67 %.

The Kavangire variety was imported into Porto Rico from Argentina only a few years ago. In Argentina it is cultivated on a large scale, thus showing that its sugar yield must be satisfactory. As it takes a very long time to ripen it is not to be recommended for general cultivation in Argentina.

The practicability of planting Kavangire generally in Porto Rico is now being studied. At the same time it has been decided to make new investigations into the immunity of this sugar cane towards mosaic disease.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERAL

786 - Recent Biological Researches on the Rusts affecting Cereals. — LOPRIORE, G.
(Communication)

The "rusts", fungi parasitic on many cultivated plants, are both widely spread and difficult to control, on account of the many and powerful means of reproduction they possess. In fact, we have neither direct,

nor indirect — preventive or curative — means of control that hold out hopes of success.

If we consider one of the commonest heteroic rusts, that is, one of those that require two different host-plants to complete its life cycle, such as the *Puccinia graminis* of wheat, we see that the appearance of the first uredo pustules, known as "yellow rust", may be caused by infection either with aecidiospores (*Aecidium Berberidis*) or with uredospores (*Uredo graminis*) and that some 8 to 10 days suffice for incubation (from germination up to the formation of new pustules).

The first uredinia may, in addition, be due to direct infection with sporidia from teleutospores or hibernating spores (*P. graminis*), without the intervention of the aecidial stage, which precedes them. According to recent researches, they may also be due to a latent germ capable of being transmitted from one growth period to another through seeds or stolons, and of commencing growth with that of the host plant. But, unlike the other two methods of reproduction, these latter require a much longer incubation period, varying from 2 to 10 months.

It may be noted that while some observations appear to show direct infection by means of teleutospores, others, equally worthy of consideration, appear to show the existence of a latent germ, living in symbiosis with the plasma of the seeds or stolons, and on which ERIKSSON has founded his theory of "mycoplasmatic symbiosis". This theory consists of two parts, one relating to the "existence", the other to the "form", of the germ.

Regarding the "existence" of the germ, ERIKSSON, in order to explain the origin of the first uredinia or summer spores, admits that there is an internal infection due to the latent germ as well as an external one due to uredo or aecidiospores. Basing his conclusions on numerous field and greenhouse experiments, Eriksson considers that the germ is certainly present, at any rate until experiments have definitely proved the contrary. He puts forward, with respect to the "form" of the germ, the idea, suggested to him by anatomical study, that the fungus, before assuming mycelial form, can exist in a state of latent symbiosis with the protoplasm of the host-plant. For the double organism resulting from this association he suggests the name of "mycoplasm".

Without giving absolute importance to the theory, but presenting it rather as a hypothesis, Eriksson expressed the hope that the progress of microchemical methods might in time separate the mycoplasm into its two organisms which are distinct from the morphological point of view.

But this hypothesis, which has analogies with other, relatively little different, examples of plant symbiosis (which are doubted by some workers), has been attacked by MARSHALL WARD, who argued from experimental evidence against the fundamental points of the theory.

Without belittling the extensive infection and culture experiments carried out by MARSHALL WARD, as well as the histological studies he made in order to find the origin of the secondary pustules and to clear up

the biology of the rust of *Bromus* spp., it is certain that the results he obtained do not impair the mycoplasma theory in an absolute sense.

From the comparative histological study of healthy leaves and leaves infected with uredospores, MARSHALL WARD deduced arguments according to which the interpretation given by ERIKSSON to his microscopic preparations was mistaken, while the mycoplasma theory, which he judged untenable, as well as the "internal germ" theory should be rejected.

It should be noted, however, that examination of organs, not in the first, but in the second stage of infection, shows that the infection is obviously of secondary origin, therefore decidedly different from that produced by an internal germ. It is thus absurd to admit the existence of latent germs in the case of artificial infection produced by uredo- or aecidiospores whose pustules appear in 8 or 10 days, while it is equally absurd to try to explain the origin of primary pustules with the same means suggested for secondary pustules and, using the histological examination of the latter as a basis, to condemn a theory that depends solely on the examination of the former.

MARSHALL WARD'S deductions are in absolute contrast with ERIKSSON'S explicit statement that the mycelia, of necessity, differ according to their origin and that the difference of the incubation periods that follow on infection with different forms of spores of one and the same species of fungus tends to show that the nature of the mycelia cannot be the same in the different stages, which shows the need for a more detailed examination of mycelia of different origins.

This opinion is given as follows: "The incubation period, which varies with the origin of the infection, suggests that the essential nature and mode of development of the mycelia cannot always be the same but that they depend on the origin of the infection, to which little attention has so far been paid". This statement shows phytopathologists the true path to follow.

Thus, in the hope that later researches will throw light on the biology of the rusts, it may be asked what rules can be deduced from one or the other mode of behaviour of such parasites.

In agricultural practice it is not indifferent whether healthy seed or seeds containing the latent germ of the infection are put in the ground. In the first case, if infection shows itself, it can only be from external causes, i. e. by means of spores from the same or another species of plant host. In the second case, even if the possibility of external infection is not totally excluded, the internal infection is due to the latent germs that the plant contains in its seed or stolon.

In the latter case, the selection of the seeds and the use of varieties of known resistance would help to limit the damage caused by rust. In the other case, the harm could be checked to a certain degree by destroying the host-plants of the aecidium in the case of heteroic rusts, but nothing could be done in the case of autoic rusts.

Resistance to rusts is also a question of adaptation. Experience has

so far shown that imported wheats are more subject to the disease than local ones.

Prof. GIGLIOLI, grew different varieties of wheat for twenty years in the experiment field of Suessola, near Acerra, in Campania, has noted that wheats from the north are usually more subject to the disease than those from the south. Soft wheats are also more subject than hard wheats.

Prof. JOVINO states that hard wheat from a maritime climate does not adequately show its resistance to rust when grown under a continental climate; this is why local wheats that are more resistant to drought often surpass them. This is what occurs with the variety "Vincetutti" which in the Tavoliere was surpassed by local varieties, while on the Ionic coast it gives good yields.

Among the most important of recent works on rust, that of STAKMAN, PIEMISEL and LEVINE, of the Agricultural Experiment Station of Minnesota, is worthy of special mention. These authors state that their conclusions do not uphold those of previous investigators, according to which the pathogenic action of biological forms is modified by the action of the host-plants. The biological forms of the rusts are apparently strictly analogous to "pure strains". They may fluctuate, but always tend to return to the normal forms. It is therefore possible, though it is not yet proved, that certain biological forms may be mixtures from which pure strains, such as *P. graminis* f. sp. *Avenae*, can be isolated. Biological forms may be due to mutation or gradual evolution; but these workers could not find any mutation, neither could they produce experimentally any modification in their evolution. The part played by hybridisation, therefore, requires investigating.

From the practical point of view, the constancy of biological forms is of special importance, because, by crossing rust-resistant varieties, very sure results may be obtained if the rust cannot promptly adapt itself to new varieties.

Different host plants had to be used in order to isolate mixed biological forms before beginning experiments with transitory host-plants — called "bridge species" — which are capable, when attacked by one form of a parasite, of making it apt to pass to other hosts on which, normally, it would not live.

Experimental attempts were made to increase the virulence of biological forms against resistant host plants by means of successively infecting them with *P. graminis* f. sp. *Triticæ*, *P. graminis* f. sp. *Avenae*, *P. graminis* f. sp. *Phleæ pratensis* and *P. graminis* f. sp. *Agerostis*. The results showed that the rusts do not become gradually adapted to hosts that are resistant and in some way related. In addition, they showed that the barberry, considered as a necessary host and as capable of reinforcing the parasitic power of the other stages, neither widens the sphere of the biological forms, nor strengthens the rusts.

Biological specialisation is apparently the same in the aecidial stage as in the uredospore stage.

Many species (*Elymus*, *Agropyron*, *Bromus*, barley) were used as trans-

itory host-plants that were equally subject to *P. graminis* f. sp. *Secalis* and *P. graminis* f. sp. *Tritici*, in order to attempt to change the parasitism of the two forms.

P. graminis f. sp. *Secalis*, which does not attack wheat, but attacks barley at once, was cultivated on the former and other (theoretically) intermediary hosts for three successive years, during which over 2 000 plants were inoculated. The rust, however, acquired no fresh parasitical power as a consequence of its association with barley. *P. graminis* f. sp. *Tritici* attacks wheat strongly, rye feebly and barley easily. The parasitism of *P. graminis* f. sp. *Avenae* is also unchanged by intermediary hosts.

The serious damage caused to cereals by rusts explains why attempts are being made to obtain resistant varieties, seeing that there are no preventive or curative remedies.

Among indirect remedies mention may be made of dressings of superphosphates, which assist the growth of the reproductive organs (ears and panicles) while attenuating that of the vegetative organs (especially the leaves). Nitrogenous manures produce the opposite effect.

Early varieties of cereals do not always give good results, compared with late varieties, as, for example, southern wheats compared with northern ones.

The rusts have other, indirect means of propagation in wild grasses (*Brachypodium pinnatum*, *Bromus mollis*, *Agropyron*, etc.) which act as host-plants for certain rusts. From the prophylactic point of view, therefore, they should be carefully destroyed, so as to avoid the hibernation of the mycelium and spores on their passing on to healthy plants.

RESISTANT
PLANTS

MEANS
OF PREVENTION
AND CONTROL

787 - **Wheats Resistant to Rust, in Sweden.** - See No 723 of this Review

788 - **Patents Concerning the Control of Diseases and Pests of Plants.** - See No 709 of this Review

DISEASES
OF VARIOUS
CROPS

789 - **Potato Mildew Favoured by the Use of Ammonium Nitrate as a Fertiliser.** - See No 696 of this Review

790 - **Cryptogamic Parasites of the Leguminosae *Crotalaria usaramoensis*, in the Dutch Indies.** - See No 729 of this Review

791 - **Diseases and Pests of Sugar Cane at Tucuman, Argentina.** - See No 733 of this Review

792 - **Onion Smut, a Disease New to Britain.** - COTTON, A D., in *The Journal of the Board of Agriculture*, Vol XXVI, No 2, pp 168-174 + 1 Plate London, May, 1919.

At the beginning of June, 1918, the English Board of Agriculture received from a private kitchen garden near Northampton some onion plants which were immediately seen to be attacked by *Urocystis Cepulae* Frost. This Tilletiaceae, generally considered to be of American origin, has caused considerable damage to the cultivation of Liliaceae in the United States

during the last fifty years. In Europe the fungus has been observed in isolated cases in France, Germany, and Denmark.

From 10 to 15 % of the onions in the garden near Northampton were attacked by the smut. The disease was found to have occurred the previous year, 1917, in a plot in the immediate neighbourhood of that attacked in 1918.

Later investigations showed that a fungus, now identified by the examination of material preserved in alcohol as *U. Cepulae*, had appeared as early as 1912, more particularly on young leeks but also on onions near Edinburgh. The same parasite was observed in 1914 on leeks and, to a lesser extent, on onions in many kitchen gardens in Northumberland, and, in 1918, was present in various other gardens in localities a great distance apart. Up to the present, however, no report had been made of the discovery near Edinburgh and in Northumberland. The fungus is not believed to have been observed in districts of Great Britain other than those mentioned. It has been proved in America that onion seed is sometimes subject to contamination by *U. Cepulae* spores. It therefore seems possible that the fungus may have been introduced into Great Britain by means of seed of foreign origin. The examination of fifty-two samples of onion seed coming from America did not, however, reveal the presence of the *Tilletiaceae* in question.

With the aid of numerous American publications the author describes the external characters of the disease, the characters of the parasite, and the methods of control.

793 - *Entyloma Ranunculi* (Ustilaginaceae) Injurious to *Helleborus niger*, in France. — ARNAUD, G., in the *Bulletin de la Société de Pathologie végétale de France*, Vol VI, Pt 1, pp 10-12 Paris, Jan-Feb., 1919

Specimens of *Helleborus niger* L., from St-Pierre d'Alligny (Savoie) and the garden of the Plant Pathology Station at Paris, were observed, in January, 1919, to be suffering from a serious disease which the author provisionally ascribed to *Entyloma Ranunculi* (Bon.) Schr. (Ustilaginaceae), a parasite that had not been recorded previously on this plant.

E. Ranunculi attacks the petioles near their base, at about the level of the soil; the petioles then wither, wrinkle up and shrink, then rot away or dry up, according to whether the weather is dry or damp. As the upper part of the leaf has its food supply cut off, it gradually dies.

On petioles attacked by *Entyloma* then develops *Coniothyrium Hellebori* Cooke and Masee which, as other investigators have reported, may attack the plant alone, when it chiefly attacks the leaf-blade. Other fungi and saprophytic bacteria then complete the work.

In order to control the disease caused by *E. Ranunculi*, seeing that the growth of the fungus at the base of the petiole shows the preponderating part played by moisture, the author suggests that rain-water should not be allowed to lie stagnant in autumn and winter, drainage furrows being made between the plants, while dead leaves, etc., that might hold up the water, should be removed. It should be remembered that *Helle-*

borus cannot withstand exposure to cold winds. The author intends to test the results of spraying with copper salts, particularly verdegri's.

794 - **The Chief Fungous Diseases of Fruit Trees, in Denmark.** — See No. 739 of this Review.

795 - **An Undescribed Canker of Poplars and Willows Caused by *Cytospora chrysosperma*, in the United States.** — LONG, W. H., in the *Journal of Agricultural Research*, Vol. XIII, No. 6, pp. 331-345 + 2 Plates. Washington, May 6, 1918.

In the semi-arid districts in the south-west of the United States poplars and willows are seriously attacked by *Cytospora chrysosperma* (Pers.) Fr. The disease caused by this Deuteromycetes manifests itself in the form of cankers on the trunks and main branches of the trees attacked. The secondary branches and twigs are also attacked but are usually killed by the parasite without any definite formation of cankers.

Pure cultures of the fungus taken from diseased areas were isolated, and the typical lesions of the disease were reproduced by inoculating healthy poplars with pure cultures of *C. chrysosperma*. This fungus was again isolated from the cankers obtained.

The fungus enters the host through wounds and dead branches.

C. chrysosperma is a serious parasite of poplars in the south-west of the United States under the following conditions:— 1) on trees growing on the extreme border of their zone of distribution which are, consequently, in more or less unfavourable environment; 2) on trees growing along roads or in cemeteries, where they are weakened by neglect and lack of water; 3) on trees pruned very heavily; 4) on cuttings in nurseries.

The fungus has been found in Arizona, Colorado, Kansas, Montana, Nevada, New Mexico, North and South Dakota, and Texas. It is also known in Mexico and in Europe.

The hosts are:— *Populus acuminata*, *P. alba*, *P. angustifolia*, *P. balsamifera-suaveolens*, *P. deltoides*, *P. italica*, *P. Macdougalii*, *P. Sargentii*, *P. tremuloides*, *P. Wislizeni*, *Populus*, sp., *Salix amygdaloides*, *S. babylonica*, and *S. Wrightii*.

The best methods of controlling the disease are:— 1) the choice of the most resistant species, abundant watering of the trees, and protection against lesions of mechanical origin; 2) the exercise of strict vigilance in the nurseries in which are grown poplars destined for the semi-arid districts of the west of the United States; 3) the complete destruction of all plants growing in nurseries which show the slightest sign of infection.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

GENERAL

796 - **Essential Oil of the Cotton Plant attractive to the Boll-Weevil (*Anthonomus grandis*).** — See No. 700 of this Review.

797 - **Life-History Observations on Four Recently Described Parasites of *Bruchophagus funebris*, in the United States.** — URBANS, T. D., in the *Journal of Agricultural Research*, Vol. XVI, No. 6, pp. 165-173 + 8 Figs. + 2 Plates. Washington, February 10, 1919.

Information is given on the biology of the four following Chalcididae, known to be parasites of *Bruchophagus funebris* Haw. This insect develops from the egg to the adult in seed of *Medicago sativa*, *Tritolium pratense*, and various species of wild *Medicago*;—

1) *Liodontomerus perplexus* Gahan., reared from *B. funebris* infesting seeds of *M. sativa* and *M. hispida nigra* in Arizona, California, South Dakota, and Iowa. This species lives parasitically on the larva of *B. funebris* and, in exceptional cases, also on the pupa. It appears to be of considerable economic importance by reducing the damage done to alfalfa seed by *B. funebris* in all the seed-producing districts of Western Arizona.

2) *L. secundus* Gahan, a parasite of the larva of *B. funebris* infesting seed of *T. pratense* in Idaho, Oregon, and South Dakota.

3) *Eutelus bruchophagi* Gahan, parasitic on *B. funebris* living in *M. sativa* seed in Utah, Idaho, and California.

4) *Trimaenomurus maculatus* Gahan, parasitic on larva of *B. funebris* in seed of *M. sativa* in Arizona, California, New Mexico, Kansas, South Dakota, and Utah. This species is apparently well established in the Yuma Valley, Arizona, where it has been observed to destroy approximately 7% of the larvae of *B. funebris* infesting alfalfa seed. It also appears to be well established in Honey Lake Valley, North-Eastern California.

798 - ***Picromerus bidens*, a Rhyncote attacking the Larvae of *Melasoma populi* and *M. tremulae*, Chrysomelids Injurious to Poplars, in France.** — VUILLET, A., in the *Bulletin de la Société entomologique de France*, No 6, pp. 118-119 Paris, 1919

At the beginning of October, 1918 the young poplar plantations of the St. Cucufa Wood (Seine-et-Oise) were severely attacked by *Melasoma populi* L. and *M. tremulae* F. A few adults and a great number of larvae were gnawing the leaves.

On this occasion the author observed two *Picromerus bidens* L., each sucking the body of a larva. Taken into captivity the two insects continued to live on *Melasoma* larvae, always giving preference to the living ones and only eating dead larvae when there were no live ones at hand.

799 - **The Industrial Utilisation of Locusts as a Means of Encouraging their Destruction.** — See No. 600 of this Review

800 - **The Control of Insects Injurious to *Hyoscyamus niger*.** — See No. 735 of this Review.

801 - ***Heterodera radiculicola*, a Nematode Parasitic on *Gomphocarpus fruticosus* (Asclepidaceae) in France.** — BIER, P., in the *Bulletin de la Société de Pathologie végétale de France*, Vol. VI, Pt 1, pp 18-19. Paris Jan.-Feb., 1919

INSECTS, ETC.,
INJURIOUS
TO VARIOUS
CROPS

The Criptogamic Laboratory of Paris has received pieces of the roots of a climbing asclepiad growing at Nice, known as *Gomphocarpus fruticosus* R. Br. On these roots were tumours varying from the size of a pea to

that of a nut. Anatomical examination of the tumours showed that they were either caused by *Heterodera radiciola* Greef, or by a biological form of the same parasite, so far not recorded from the plant in question.

802 - *Monohammus* sp., A Vine-Destroying Longicorn Beetle, in New South Wales, Australia. — FROGATT W. W., in the *Agricultural Gazette of New South Wales*, Vol. XXX, Pt. 2, pp. 129-131 + 1 Plate. Sydney, February 3, 1919.

At the beginning of November, 1918, the author visited the Hunter River district where a boring insect had been reported as doing serious damage in the vineyards. The author found no adults of the parasite, but during the first week of December the perfect insects emerged from two pupae collected in the vineyards and made it possible to identify the insect as *Monohammus* sp.

This coleopteron, the life cycle of which probably lasts a year, appears to lay its eggs on the outer surface of the bark of the main stem 4 or 5 inches above the ground. The larvae sometimes live under the bark, on one side of the stem, but more usually they bore a gallery which penetrates to the centre of the stem itself. The larvae pupate in any part of the stem, just below the bark, at the end of a gallery. In some cases from 5 to 10 % of the vines are injured. A workman with good sight could, with a little practice, destroy a large number of the larvae by removing them from the plant or killing them in their galleries.

It seems probable that the insect developed in the neighbourhood of the infested zone at the expense of some other soft-wooded tree, such as the fig tree, and that, its original host having disappeared, it passed on to the vine. If this were really so, its attack on the vine, a plant which does not appear well chosen to shelter the larvae of so large a coleopteron, may be considered as exceptional and of short duration.

The coleopteron in question, which has been briefly described, is very similar, in the different stages of its development, to *M. fistulator*, which the author recently described as injurious to cultivated *Passiflora* (1), and can be nothing but a simple variety of this species.

(1) See R May, 1919, No. 674. (*Ld.*)

INTERNATIONAL INSTITUTE OF AGRICULTURE
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FIRST PART.
ORIGINAL ARTICLES

Agricultural Tractors and War Tractors:

The Problem of Adhesion.

By C. JULIEN

*Staff Captain, President of the "Chambre Syndicale de la Motoculture de France"
Member of the "Comité Supérieur de l'Outillage Agricole"*

After following for a certain number of years the evolution of the manufacture of apparatus used for mechanical cultivation in the various countries in the world, it becomes evident that the chief difficulty in the way of realisation (at least from the practical agricultural point of view) lies not only in the quest for better engines, or even for the most economical fuel but above all in the conception of an ideal apparatus having a motive force, of whatever source and power, which can give the maximum amount of *useful work* (i. e., in area worked or in volume of land ploughed). To be precise, it may be stated that the possibilities of the output of motor cultivating machines are of less importance than the means available in each type of machine for reducing as far as possible the losses in moving, i. e., losses of motive power caused, not by resistance to work, but by difficulty in moving along.

In all cultivating implements driven by mechanical means, the gross power produced at the driving shaft is lost in the following three directions: — (1) The amount absorbed by the mechanism, gears, etc., up to the coupling hook; (2) the amount absorbed by the work proper, that is,

the resistance offered by the soil to the action of the working implements or to their progress ; (3) the amount represented by the inertia which the machine, including sometimes the working implement, exerts against being moved on the land it is working.

Losses of power in the machine itself may be reduced to a minimum by a rational study of the conditions under which the various parts work, by thorough lubrication and by complete protection against undue wear or against abnormal friction ; we shall not enlarge on this point here except to remark on the interest in these respects of recent industrial productions of French make and also of certain foreign designs made with the same ends in view.

As regards the amount of motive power absorbed by the resistance of the ground to the working implements, which, properly speaking, constitutes the useful output of the machines, this naturally varies greatly according to the kind of soil, the nature of the work and the implements used, and in practice is generally dependent on the amount of motive power which the machine possesses after deducting the power absorbed in its own mechanism and in moving itself forward. Hence it is of the utmost necessity closely to examine the latter quantity and to seek out the various factors which can make it vary.

Driving wheels. -- On regarding one by one, in technical reviews, or in catalogues or — best of all — at international trials and demonstrations, the various types of tractors employed in agriculture, the observer is struck by the strange diversity of their driving wheels as regards number, dimensions, width of tyre and the infinite variety of projections, fixed or mobile, with which the rims are furnished.

All begin, of course, with a practically smooth rim, as these machines must, to reach their place of work, pass through a farmyard highway, or road—i. e. a hard surface which, in the case of a public road, the authorities insist must not be unduly damaged. But once the machine reaches the field these smooth or almost smooth rims are not sufficient to grip the cultivated land and so overcome under the best conditions the resistance which the ground offers to the action of the working implements. Then it is that the variety appears in the means used or recommended by the makers so that the farmer may obtain from the machine the profit he expects.

It will suffice for us to enumerate some of these means, certain of which are covered by patents, to deduce therefrom an undisputable fact, viz. that most tractors, when moving, absolutely depend within wide limits of the *surface condition of the soil* on which they have to work, and not only on the slope of the land but also on the physical consistency of the arable surface.

If we were to make here a detailed technical and critical study of the many solutions and various means of adhesion put forward by the makers, we should have to examine the commonest devices from the three points of view of the *form* of the gripping members, their *position* and their *number*, showing the results obtained with each kind of wheel and considering

the *weight* borne by the wheel. We shall here simply indicate the main points about the chief kinds of commercial devices which are universally known.

Starting from the principle that on a uniform surface like a rail track a haulage machine — e. g., a locomotive — pulls all the more the heavier it is, other means of adhesion have been sought, for road or field, than those provided by the weight of a heavy moving body at the point of contact of its wheels with the ground. It is also certain that when the ground is in a state of dryness and compactness such as permits of its supporting this weight, like a highway or road, there is no need to seek a better solution : it is only necessary to get, on the few square centimetres or decimetres of soil surface which is in contact with the driving wheels, such pressure, that, without the wheel slipping, the motive force applied at the tangential point will suffice to overcome the resistance met by the advancing implement which is being hauled. This is the primitive solution which has been for many years the basis of nearly all the American devices, and which certain colonists of warm countries, indifferent farmers, seek for or recommend.

As it is only necessary that a slight rain should fall for these machines with smooth-faced wheels to slip and skid, whatever be their weight (by this word we mean simply the relation between the actual weight and the contact surface of the wheels, i. e., the specific *pressure* exerted by the rim) ; and as it would be unreasonable to wait for the ground to become hard and compact for ploughing, hence the need becomes evident for supplying the wheels with suitable means to prevent their slipping after the slightest rainfall.

Gripping devices. — The commonest solutions consist in placing on the rims of the driving wheels variously shaped small bars or angle irons with symmetric or unequal blades, these being placed sometimes parallel to the axle, sometimes obliquely, and projecting in some cases beyond the edge of the rim. A glance at one of these wheels at work (see Fig. 1 to 12) shows that the bite taken in the soil by the projecting piece has the effect, according to the height of the projection and the weight borne by the wheel, of giving the tractor a grip on the path it is following, and hence increasing relatively the pull at the drawbar. For the wheel to slip, it is necessary that the projection in action should in its rotation carry away a layer of earth of a depth limited by the height of the grip itself ; this depth may suffice in certain cases, to act as a support to allow the vehicle to advance ; but, according to the resistance at the draw bar, the wheel in motion may very soon be unable to move on in relation to the soil. At this point slipping is taking place underneath, not between the metal face of the wheel and the upper layer of soil but between the thin layer of soil carried away by the grip and the earth below it. This rubbing of earth against earth evidently gives an excellent coefficient of work done, and for this reason, in practice the adoption of such a simple means as an angle iron (or strake) has been able to give relatively good results as regards grip.

On close examination, however, it is clear that a wheel, once provided with these grips, has obviously only limited possibilities of gripping the

soil. Every time, in fact, that the resistance at the drawbar, whatever the conditions of work may be, is greater than these possibilities — which are determined by the machine being constructed independently of the *soil* factor — the wheel will inevitably slip and so will be unable to utilise the available power of the engine ; the driver will then have to lessen the resistance to moving forward by raising the implements, for example, thereby disturbing the uniformity of the work.

If the strakes do not extend beyond the edge of the rim of the wheel, the earth collected will heap up at the foot of each angle so that the whole wheel is increased in diameter or else is of irregular outline, which shows the necessity for arranging the working blade of the iron so that it can clean itself automatically. This has led to the grips being placed more or less obliquely to the axis of motion, or to their being cut in pieces and placed alternately to or opposite one another. We should see, if we could examine each machine in detail, that the necessity to clean the grips has led several European manufacturers to adopt intelligent devices for automatically clearing the wheel of the adhering soil it may carry away with it, but already it may be stated that every form of bar or angle iron acting on the outer face of the rim, whatever be its length, height or angle, has in advance *absolutely limited possibilities of adhesion*, so that it is not surprising if tractors fitted with these are, in ordinary conditions of agricultural operations, unable at times to do the haulage work expected of them by the farmer, or even to make headway alone.

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Before proceeding further with the examination of the different kinds of protuberances used to replace or supplement the angle irons, it should be remarked that the fixing of such pieces or any appliances to supplement these, on to the wheel rim, presents not exactly difficulties, but such inconvenience to the farmer as may often debar the use of the machines. Whether these appliances are fixed on by bolts, screw-rings or clasps, several hours' work is needed every time the tractor is to pass from field to road or vice versa, and the time so spent is never made up for. For this reason many makers have tried to evolve grips (angle irons, plates or other devices) which can disappear into the interior of the rim when road work is to be done, and in this respect they have succeeded in controlling the movable projections by eccentrics running solid from the centre of the wheel (Landrin method, Fig. 14), or they have sought to supply the wheel at the required time with an additional rim of two or more segments which bear the angle pieces or projecting parts fixed in themselves (Fournier, Montet, etc., methods).

These are chance solutions of the problem, sometimes quite good, but they detract in no way from what we have already said regarding the gripping abilities of any tractor wheel having its outer face armed with angle

irons or similar devices, plates, etc. We may remark, moreover, that a maker can always give the gripping part of the plate or angle piece such a depth that it can absorb all the power of the engine. In that case he will run other risks, the chief of which is the following : — on a loose soil free from stones the blade sinks without difficulty and takes the most powerful grip, but on a firm, hard or stony soil too long a blade never sinks all its depth and so acts like a lever to displace the wheel. There is no need to emphasise this drawback, which is met with on all systems of wheels having powerful projecting pieces, in particular one of the most interesting, the Stock wheel (Fig. 8). We shall have occasion to refer again to the latter device, which is one of the most typical as regards the quest for the maximum grip.

* * *

Theory and practice, therefore, agree perfectly in showing that the use of angle pieces and all similar means, placed on the rims of the wheels, restricts thereby, to a greater or less but always considerable extent, the possibilities of the utilisation of the engine power available for useful work. Whatever has been done in addition to facilitate the cleaning of these pieces can detract from this statement only slightly. This latter point, however, is not without value, for if a mass of earth or grit can gather or stick at the base of the gripping blade of the attachment, the blade is thereby directly prevented from penetrating completely into the soil.

This shows that the types of wheels that should give the best results from the haulage point of view are those which have external projections of the largest size and have the most effective means for continuous cleaning. Thus, after reviewing the infinite variety of angle irons and blades, we are led to the conclusion that the most efficient wheels are, on the one hand, those of the Stock type, *with narrow rims and wide plates projecting beyond both edges of the rims*, and, on the other hand, those of the Landrin type, *with wide controlled plates, sliding in a slit in the rim which automatically cleans them*.

The Stock wheel has, apart from all other considerations, the following characteristics : — the rim, smooth and narrow, is overlapped on either side by plates situated in a plane parallel to the axle, though this plane does not necessarily pass through the axle. These plates, in machines of the kind which have been brought out, have a depth of over 12 centimetres and a width in the parts projecting beyond the edges of the rim on either side altogether about equal to the width of the rim itself. It will be seen that when such a device, with a surface therefore of several square centimetres, is working on a suitable soil, the tractor obtains a good hold on this soil and can show at the drawbar all the power available from the engine ; Stock wheels, on equal work, do not slip when the wheels of other tractors of the same power become incapable of hauling their load. These are unquestion-

able advantages, the results of a judicious study of the problem, but they have other drawbacks, in particular those indicated above, viz. — too great depth of plates, slowness in fixing and unfixing, unsuitability for work on stony or too dry soils, etc.

The necessity for being able to pass quickly from field on to road, and vice versa, led to the Lefebvre (Fig. 15 and 16) or Landrin (Fig. 14) systems. In the former the driving wheels have smooth rims but are supplemented at the proper time by a powerful gripping member which puts into action simultaneously a certain number of plates mounted on an endless chain, which supports the tractor as would a wheel of very great diameter furnished with similar plates. In the latter of the above two systems, the driving wheels also have smooth rims, and these wide rims contain slits through which there are pushed at the right moment plates worked by connecting rods off an eccentric; but these plates, which are very well cleaned in their movement in and out, have the disadvantage compared with the Stock type, of not being capable of projecting beyond the outer edges of the rim, and for that reason are of restricted dimensions which limit, as in all types with external projections, their range of adhesion.

Some makers have thought to correct the inconvenience of plates and angle pieces by using pyramidal or blunt cone-shaped protuberances which as they clear themselves rather better, consequently allow of more useful action being counted on. This method is adopted in tractors with a single driving wheel in the shape of a drum (Gray, Emerson, etc.) which derive certain advantages from their shape but also are liable to too great drawbacks. These systems claim to obtain extra grip in this way, giving a relatively stronger haulage effect without causing the abnormal packing in the soil — an undesirable condition from the agricultural point of view — which is caused by the ordinary tractor wheels on the bottom of the furrow and on the headland. But in this respect they are outclassed by a much more interesting and ingenious type, viz., machines with *jointed rims* which carry their own pathway (Caterpillar types, with movable track).

Chain-track machines. — The great argument advanced by manufacturers, at present fairly numerous, of chain-track or *Caterpillar* tractors (Figs. 17, 18, 19, 20) to secure general use of their machines in agriculture, is that the Caterpillar *does not pack the soil*. Since before the war, the American Holt Caterpillar has claimed that in spite of its weight of 10 tons its pressure on the soil amounts to only 400 grammes per square centimetre of surface. This argument is therefore quite to the point and a valid one in the domain of soil science, and brought at the beginning success to these machines.

It must be admitted that this commercial claim would perhaps lose some of its assurance on thorough investigation and considering that the weight of the machine is not so evenly distributed as is believed over the entire surface of the chain in contact with the ground. In reality the points on this surface which transmit the greatest pressure vary according to the contour of the ground, being sometimes at the fore end and sometimes at the after end of the chassis but rarely in the middle, so that the weight does

not bear on all the lower links of the chain equally but only on some of them, while the earth gets well packed down just as it would by the passage of an ordinary wheel of suitable dimensions.

Now, it must be affirmed, the adhesion of the Caterpillars is entirely due to their weight, and it is not through their more or less ingeniously roughened "shoes" that they could be lightened. All types of Caterpillar tractors, of whatever form, absolutely cannot be made into light machines and be brought down for example to under 100 kilogrammes in weight per horse power (they all weight over 200 kg. per h. p.) nor can they exert more than a relatively very weak pull. These tractors therefore belong to the heavy class in the first American type which aims at obtaining grip by means of weight; they simply make good use of this massive weight by spreading it over a jointed track which unrolls under the driving wheels of the machine as it advances, the jointed track being itself mounted on wide bottomed shoes bound to each other and spreading over a large area of soil without sinking into it too far.

Other types of chain-track tractors have been evolved in which the track is not jointed but is a fixed frame round which run rollers bearing jointed shoes (Fig. 20). Still other types have a very short chain-track mounted on a small trapezoidal frame and thus form a sort of *triangular wheel* which fits on to the axle of the lorry or tractor. Vehicles fitted with these wheels, which rest on the ground with one side of the triangle, acquire the double ability of being able to go on to difficult ground without sinking into it, while possessing enough grip to let the vehicle and its load pass over it.

As this is one of the latest designs suggested by experiment, it may well indicate a fairly novel line justified by the need for simplification of the mechanical parts of Caterpillar tractors which, in their present form, involve inconveniences which cannot escape notice in agriculture, in particular the poor protection and the wear of the chain-track members.

In short, on glancing back over the various means of adhesion which we have hitherto examined, we see that two types of motor haulage machines having the best gripping powers, and thereby able to show the strongest relative pull at their drawbar, are, on the one hand, those of the caterpillar type, because they are supported on a wide outside surface of the soil, and, on the other hand, those of the Stock type, because they are supported by a wide grip inside the soil itself. The wheel of the Stock type, however, has a double advantage over the other — (1) It has a simpler and more usual construction, permitting better protection of the machinery; (2) it may be adapted to machines much lighter for the same useful hauling power. Now, the latter quality would in itself suggest in what direction research should be made as the realisation of relatively light and powerful machines is to-day the ideal of the agricultural world, — which manufacturers have up till now forgotten to consult, as if the problem of motor cultivators were not in the first place an agricultural problem. *

Wheels with internal adhesion. — A new form of wheel — that is, new as regards its rim — made its appearance at the last international motor-

culture trials at Paris, fitted to the *Motoculteurs*, rotary cultivators and tractors made by the "LA MOTOCULTURE FRANÇAISE" (S. O. M. U. A. make, branch of the Creusot Co.).

This rim, protected by patents, should provide tractors, even light ones, when working in the fields, with *progressive* gripping powers, in such a way that all the available engine power, allowing for that absorbed by the gears and in going forward, may *always be wholly employed* at the drawbar *without the wheels slipping*. Evidently, this is the practical aim to be attained, and it is desirable to find out whether this invention really supplies a general technical solution.

It may be remarked at this point : —

(1) That the problem of adhesion on rails, for all haulage machines, has found its general technical solution in the factor of weight : the heavier the locomotive the greater the load hauled, the heavier the chain-track tractors (Caterpillar and similar types) the greater their useful power at the drawbar.

(2) That the problem of adhesion on *roads* for all motor vehicles, touring or transport, has found its general technical solution in the use of rubber tyres ; a suitable relation between speed, weight and the rubber-tyred wheel in contact with the ground permitting all requirements to be met.

Again, if the rail track and the roadway are, as surfaces for travelling on, very different from the surface of arable land and even of farm roads—to such an extent that dozens of different gripping appliances are employed among the hundreds of makes of tractors—it is not therefore to be excluded that a general technical solution should not be sought and could not be found for all machines which have to move their own mass over different kind of ground, and especially for those machines which have, in addition, to show at a drawbar, for whatever purpose (transport, haulage, ploughing, etc.) a useful haulage force. Let us see what may be, in this respect, the bearing of the recent invention, of which the first application has been made to the driving wheels of the *Motoculteur* (Figs. 21 and 22) and to the driving wheels of a lorry-tractor (Figs 23 and 24).

The patent specification states "the driving wheels of tractors or of divers agricultural machines should, as regards running, fulfill the following general conditions : —

"1) Have a practically smooth rim so as to be able, like ordinary vehicles drawn by animals, to run on highways and roads.

"2) Be provided, however, from the time when they reach the field, with normal possibilities for adhesion, which the flat rim alone could not give.

"3) Have means of adherence of progressive efficiency ready, so that the machine may be able, no matter what the difficulties in running are, to apply usefully to its maximum the available motive power to overcome these difficulties.

"This invention aims at fulfilling all these conditions by simple means".

Such is the problem tackled by the inventor, and here is how he has solved it : —

This result is obtained by means of a flat rim of circular shape, having fixed to its *inner* surface V shaped protuberances which project beyond the edges of the rim on either side. Each protuberance may itself serve to support a complementary gripping plate which can be put on without screws or bolts and which projects out from the outer edges of the rim.

The appliance works as follows : —

While the rim, whether it be a flat iron one (Fig. 25) or one carrying a rubber tyre (Fig. 24) has not the extra plate attached, it can run freely on roads and highways.

Whenever the machine enters a field, the rim tends to sink into the ground (fig. 26), so that the lateral projecting pieces become embedded in the ground also and the more the wheel sinks in the more they help to overcome the resistance to travelling.

As the number, size and position of these internal projecting pieces can be regulated in manufacture, it results that they will suffice in most cases to secure enough grip to the wheels when working.

Should the kind of the ground or the work to be done be such that this permanently fixed device is not enough, the wheel then is further equipped with removable complementary plates (Figs. 23 and 27) which, sticking out beyond the wheel face, take a deeper bite on the soil for giving the maximum grip (as does a strake of the Stock type).

The projections, like the plates, may be arranged on one side only or on both sides of the rim, opposite one another or alternately.

The drawings shown in Figs. 23 (ordinary rim), and 24 (rubber-tyred rim), in which the hypothetical earth-line X-Y indicates the position of the rim when it is sunk in the soil, show still more clearly the gripping powers of the wheels fitted according to this new method whether the wheels have iron, wood or rubber tyres.

The idea of thus seeking to obtain adhesion not on a circle of greater but on one of less diameter than the internal diameter of the rim, whatever the latter may be, would seem to solve in a neat and simple way a very difficult and hitherto insoluble double problem.

Its almost general application in time to motor cultivating machines — which are obliged to pass in turn from field to road and vice versa, and intended to exert very variable haulage efforts, according to the nature of the work and of the ground — would appear to be all the more certain (barring patent reservations), seeing that the appliance can be put on wheels for all powers and of all diameters for all kinds of tractors.

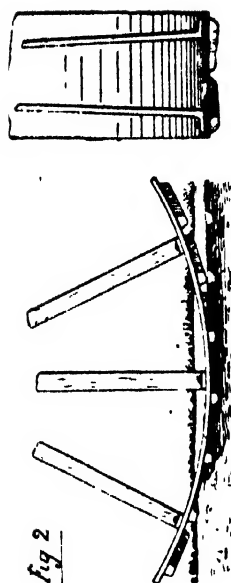
Its application to lorries and to all motor machines destined to pass immediately from roads on to different sorts of ground, either to move over them or to do haulage work on them, would also appear to be of greater interest, as a wheel so equipped with internally projecting pieces is always ready to work normally on road or field. The extra plates need be put in action only under exceptional conditions, being fixed in only a few seconds,

without screws or bolts, as was demonstrated on wet ground at the trials.

The Motoculteur wheel will not stick : loose earth on which it is rolling lets the projecting pieces sink and always get a hold on the solid bottom below, while any soil carried away falls back vertically if the projections, of triangular section, are set at a sharp enough angle and sufficiently apart from each other. The two driving wheels of the Motoculteur, placed on either side of the light strong chassis enclosing all the mechanism, confer on this machine, in its various forms, exceptional qualities, including non slipping properties which neither the Stock nor the Caterpillar types can attain to.

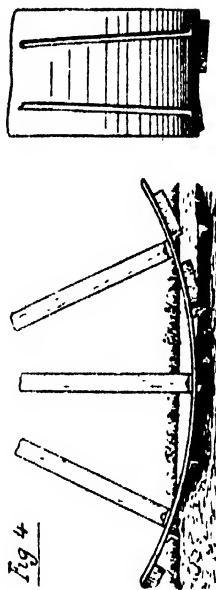
Hence the advantage will be seen which tractors with four driving wheels may derive from this new rim with progressive adhesion powers, both for agricultural and for warlike uses, especially in the motor haulage of artillery and for supply columns.

Fig 2



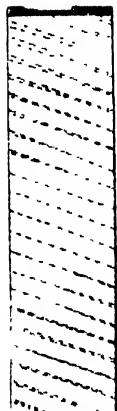
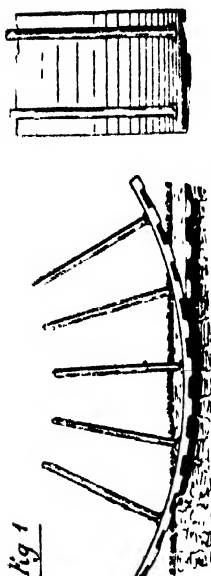
Small bars fixed near each other, as on heavy machines like the RUMSEY, RUSSETT, etc.; the spaces between bars collect the earth and grit, thus raising the coefficient of friction with the ground.

Fig 4



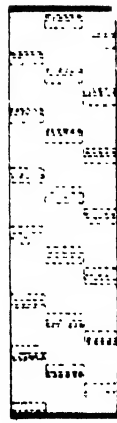
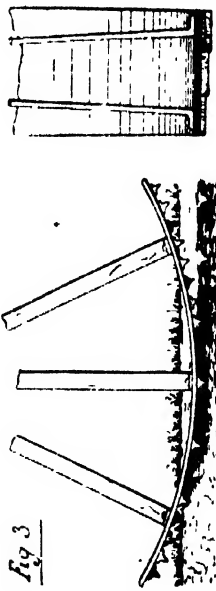
Fixed protuberances more widely spaced: a form tending to ensure to some extent self-cleaning: widely diffused with various modifications, as on the AULTMAN, TAYLOR, HARRISON, etc.

Fig 1

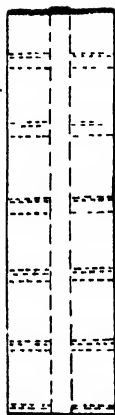
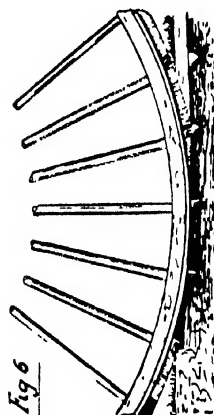


The most usual form on the chief makes of steam and traction engines: CASS, FORSTER, MACLEAY, RANSOME, etc. with or without additional means for securing adhesion by weight, on hard ground.

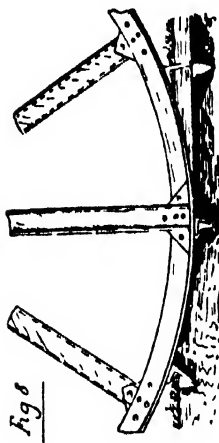
Fig 3



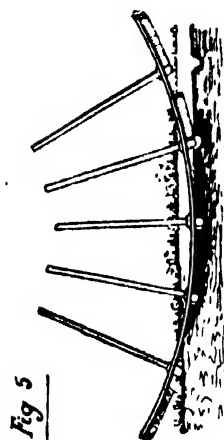
Alternating fixed protuberances; on many makes, blunt-cone shapes grouped in the same way are substituted for the bars, MOLINE, KINNARD, CLAYTON, EMMERSON, etc.



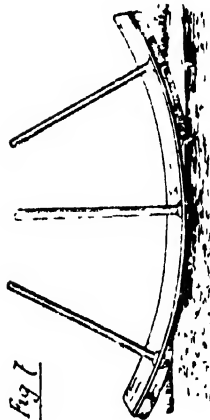
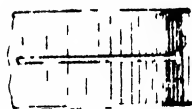
The necessity for road-traveling has led to similar devices being fitted by many French makers, such as BAJAC, DUBOIS, BAUCHE, etc. on which the NILSON is also modelled.



Narrow rim, with more or less removable plates projecting out beyond its sides, as in the German types SROCK, BAKER, ALBA, WENDELSE, etc., obtaining great adherence by a good bite on the soil.



Chevron shapes fixed with more or less open angle, adapted on many light machines, like the CLAYTON, or with variation as in the "Universal" type etc.



The same idea is here shown in the crossing of angle irons on the wheel face, to obtain a better hold on the ground, as in the LINARD.

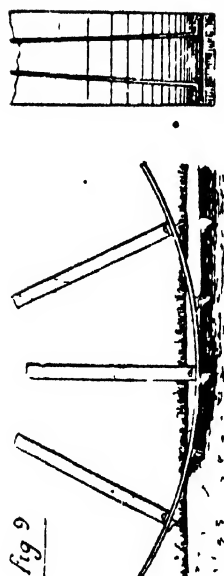


Fig 9

a



Simple angle irons, not projecting beyond rim edge, having a more or less powerful working blade, and arranged in various ways on the wheel face, as in the fairly light tractors EAGLE, WALLIS, GALARDI, etc

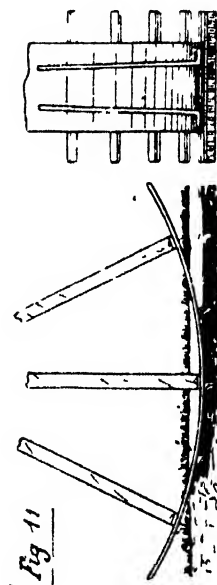
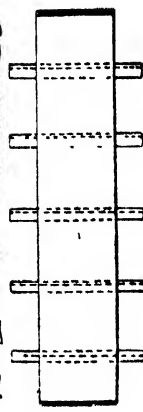


Fig 11

c



On very wide rims, projecting pieces are of no advantage, unless for easier fitting laterally, as in various common types

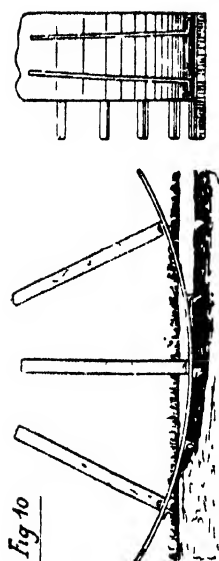
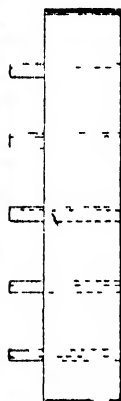


Fig 10

B



Angle irons projecting beyond rim edge and fixed by rather ingenious means figure on some tractors the HART PARR has a powerful modification.

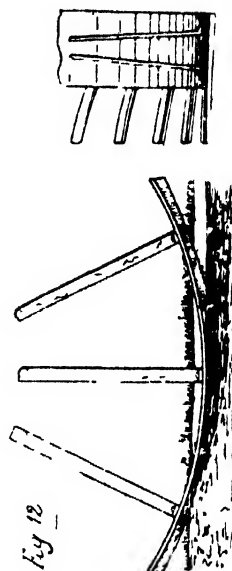
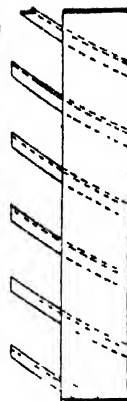


Fig 12



Oblique angle pieces extending well beyond the rim edge, and sometimes very skilfully fitted to facilitate removal, figure on the GALLOVAY, Mogul, Ohio Mg, etc.

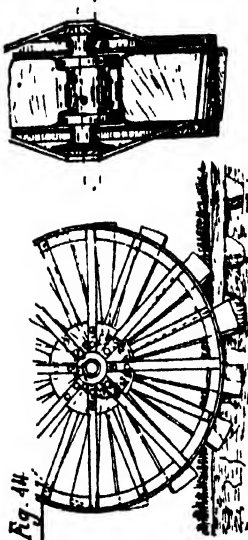
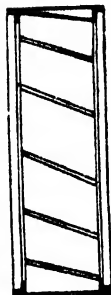
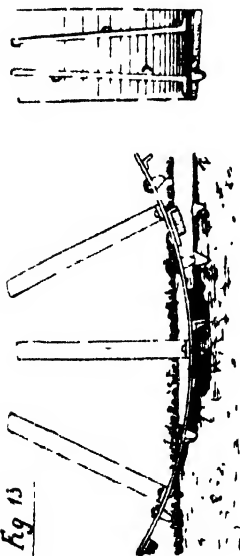


Fig. 13



Blunt-cone projections, with or without the addition of cross bars, are at the present time most general in its forms, as in the CHALMERS, MOLINE, FORD, GRAY, MESWAY, etc.

The LANDRAIN anti-skid wheels owe their power to the dimensions of their mobile plates which grip the ground, and are self cleaning.

Fig. 16

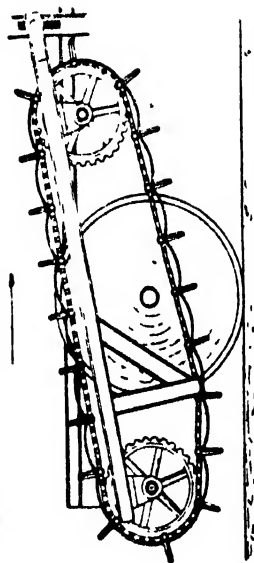
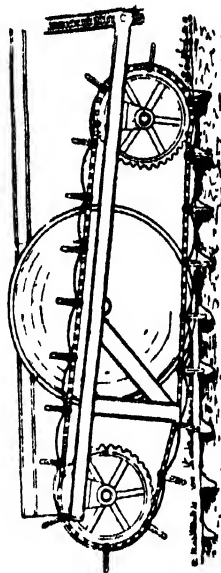
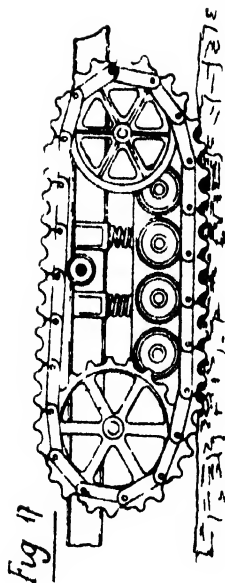


Fig. 15

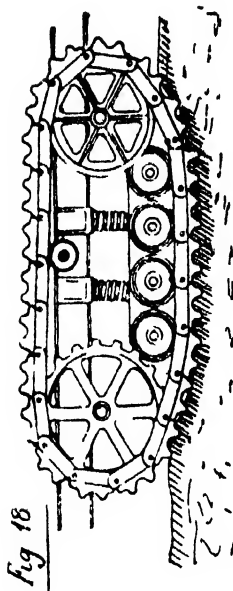


For heavier work it provides these wheels with a more powerful extra grip than can be had by the plates on the MAILLIER, PAVESI, PARKER wheels.

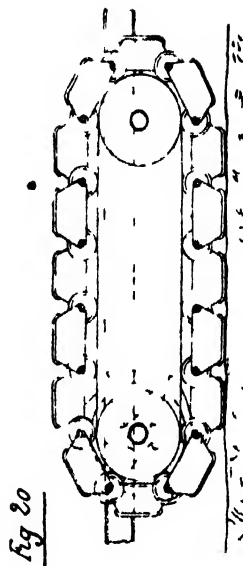
The LEROUX plate-carrying chain is raised for running on a road or for light haulage, when the normal driving wheels



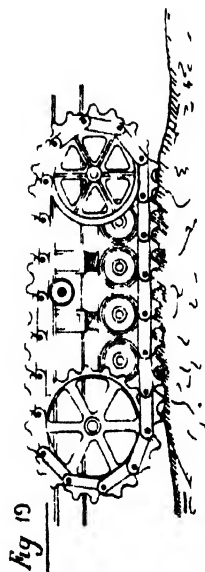
The Holt caterpillar is the origin of this massive type repeated by the BLOOM TRACKLAYER BUCKYF etc and by the first European makers of tanks



The chain track follows within certain limits the ups and downs of the surface but pressure is unequally distributed and leads to very heavy compression on the chain track

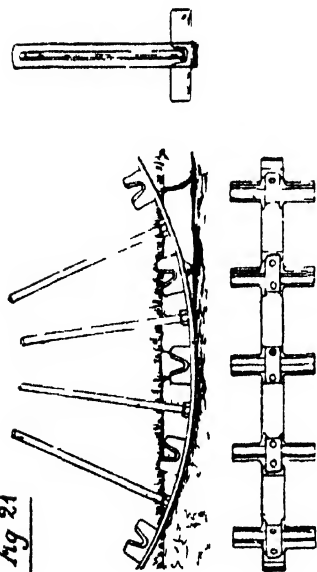


Type with rigid frame serving as path for the bearing members of the chain as in the RAILMOBIL, CURVED PHOENIX, DIFLOCK, YUMA, etc and various light "tanks"



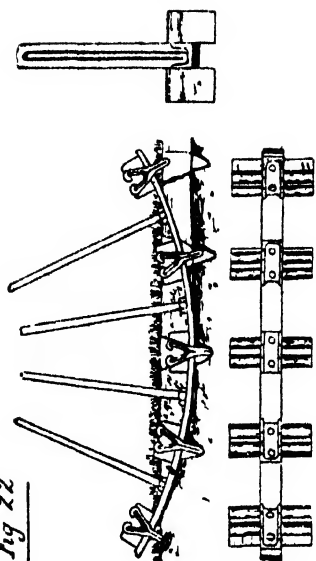
On a rough surface almost the whole pressure is at the centre of the chain, the small trapezoidal chain tracks of the DAYTON STRAIN, etc, types cover the ground better

Fig 21



Sona wheel with progressive adhesion narrow flat rim carrying on its inner surface protrusions of special shape widely spaced and extending well out beyond the rim edges runs equally well on road and ground of varying character

Fig 22



The additional removable plate for use only on too soft ground does not diminish its properties powerful grip on the soil and automatic cleaning

Fig 23

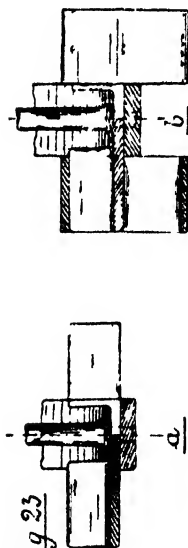
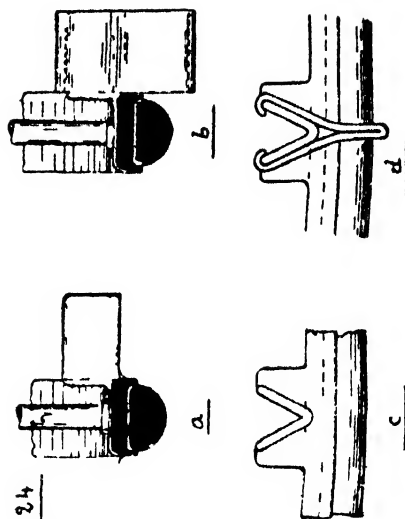
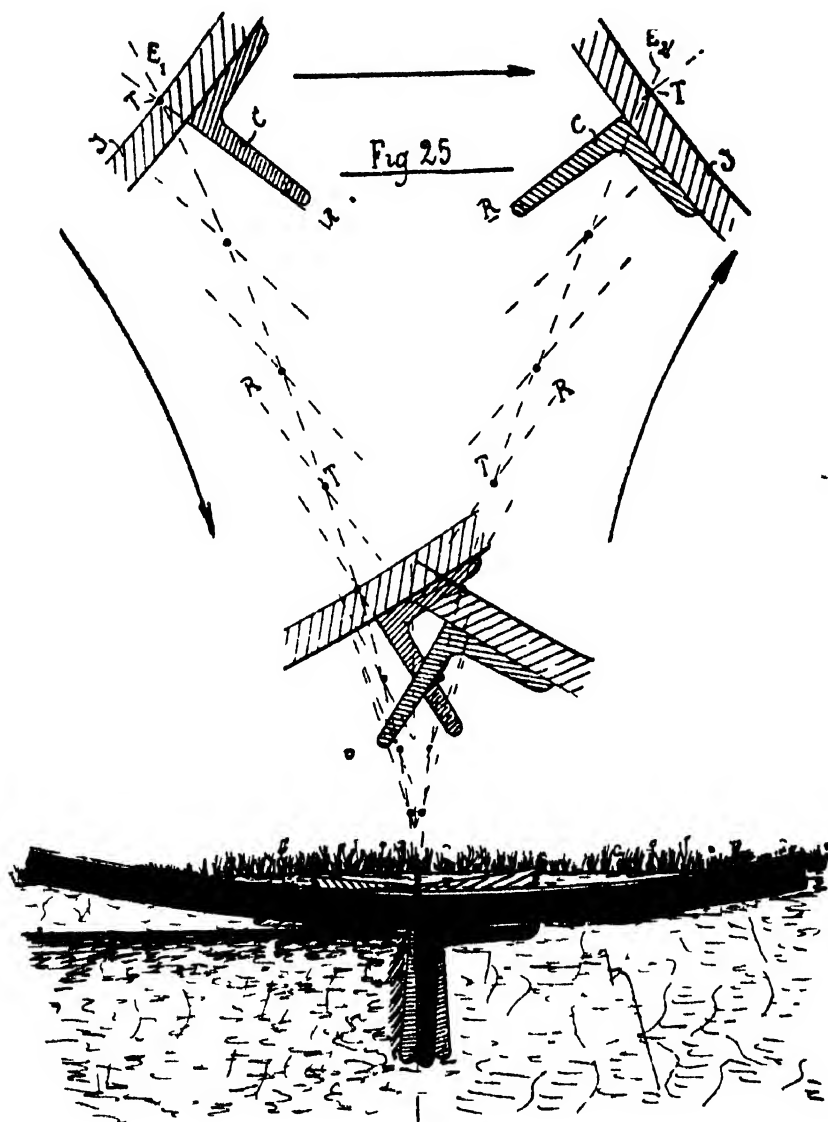


Fig 24



Normal



Actual successive positions, during revolution of an external gripping member on the rim (angle piece) during the advance of a wheel of 140 cm diameter a large ring revolves near the surface of the ground but loses grip as it sinks in, the external protuberance having its effect limited in advance

SECOND PART
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

803 - **The Agricultural Resources of Morocco.** HITIER, H (from a report by M. E. BARTHIN Deputy) in the *Bulletin de la Société d'Encouragement pour l'industrie nationale*, Year CXVI 1st. Half-Year, Vol CXXXI No 2 pp 348 363 Paris March April, 1919

Morocco has helped considerably in provisioning France during the war. For example, in 1916-1917 it supplied 400 059 quintals of hard wheat, 1 603 192 quintals of barley; 185 228 quintals of maize, 62 014 quintals of beans 14 370 quintals of wool, 55 692 sheepskins, 554 943 goat-skins, 57 94 pigs; 6 230 head of cattle, etc. Morocco, during the same period, fed the army of occupation and the civil population, the latter in the French zone amounting to nearly 6 million inhabitants

The report by M. BARTHE on the agricultural resources of Morocco made in the name of the "Commission de Douanes de la Chambre des Députés de France" (a report based on information supplied by the Department of Agriculture, Commerce and Colonisation of the Protectorate by N. COSNIER, High Commissioner, and by numerous correspondents), bears witness to the fertility of the country and the industry of the people inhabiting it. The author takes from this report the data of his own paper and refers his readers to the paper of M. A. BERNARD, included in the same publication (1), for the general resources of Morocco.

CEREALS. — The cultivation of cereals holds the first place in Morocco, and extended in 1917 over 1 599 940 hectares out of a total cultivated area of 1 681 353 hectares, or about 95 %. Owing to unfavourable climatic conditions the yield is small, being only 7 quintals per hectare, and even, in many cases, scarcely 3 quintals. The reason why cereals hold such a position is because they form the main food of the natives and require the employment of small capital.

It would be advantageous to develop the cultivation of food plants

(1) See R, March 1919, No 272 (Ed)

other than cereals and particularly that of leguminous plants for which the conditions in Morocco are very favourable. At the same time technical progress would enable the yield of cereals to be increased if, following the example of European settlers, the natives practised spring and summer ploughing and introduced fallow cultures of leguminous plants into the rotation of crops.

The author studies successively wheat, barley, maize, oats, white Moroccan sorghum (called "dra" by the natives), millet, and canary seed.

LEGUMINOUS FOOD PLANTS. — These are, in the order of their importance, beans, chick peas, lentils, fenugreek, peas and haricot beans. Experimental cultivation of groundnuts, *Dolichos* and soya beans has also been undertaken.

STARCH AND SUGAR YIELDING PLANTS. — The plants yielding starch or sugar found growing or cultivated in Morocco are : The asphodel, squill, cactus, carob, potato, sweet potato, and the Jerusalem artichoke. Beet has been cultivated experimentally at the Rabat station, and from the experiments it was found to grow normally without irrigation, except for occasional injury from frost in certain parts of the coastal zone, and favourable ground was chosen; but no conclusion can yet be arrived at regarding the industrial value of this cultivation and the experiments, carried out at the Rabat, Meknès, Fez and Marrakech stations, must be continued for a long time.

Sugar cane has disappeared from Morocco where formerly certain regions were considered sugar producing. Since 1915, the cultivation of this plant has been tried in the experimental gardens at Mazagan and Marrakech.

OIL-YIELDING PLANTS. — Morocco is now able to furnish vegetable oils produced from the olive, iron wood (1), walnut, almond, linseed, hempseed, castor-oil seed and sesame. At Rabat and Mazagan experimental cultivation of groundnuts has been successful and will be extended over large areas.

FIBRE-YIELDING PLANTS. - - Hemp is the most important and its production is considerable in the régions of Meknès, Fez, and Marrakech.

Flax, cotton and ramie are at present only cultivated experimentally. On the other hand the dwarf palm (*Chamærops humilis*, or "doun"), alfa, etc., have always been used by native workmen and will be capable of furnishing abundant raw material for European fibre industries.

TANNIN-YIELDING PLANTS. — Tanning substances used for Morocco leather are chiefly oak bark tans and "takaout", the gall of *Tamarix articulata*.

SCENT-YIELDING PLANTS. — No European industry for distilling scent-yielding plants at present exists in Morocco; it could be established.

CONDIMENT-YIELDING PLANTS. — Cumin, coriander and carraway hold a relatively important place in Moroccan commerce.

(1) For the iron wood in Morocco see *The forest resources of Morocco* by M. ABEL GAERDEY reviewed in R., April 1919, No 475 (Ed).

KITCHEN-GARDEN PLANTS AND EARLY VEGETABLES. — The future of such plants appears to be uncertain for economic rather than technical reasons.

ORCHARDS. — These could be largely developed in Morocco and fruit, being less perishable than kitchen-garden produce, could be exported. The principal fruit trees are the fig (by far the most common in the fruit gardens; there are over a million in Western Morocco), walnut (in the Riff and on the slopes of Mount Atlas from about 300 to 2 000 metres in altitude: the export of walnuts in 1915 amounted to 8 669 quintals), almond (3 797 748 kg. of almonds was exported in 1913), citrus fruits (almost all kinds), date palm.

VINES. — The returns show 5 766 hectares of vineyards owned by natives. Vineyards under European management are of quite recent creation. The wine produced is in every respect similar to the wines of Algeria and Tunis.

LIVE STOCK IN MOROCCO (1). — The total value of the live stock in Morocco amounts to about 700 000 000 francs. The production of live stock has a great future, for the climatic conditions are, almost everywhere in the country, favourable to the growth of grass.

The regular increase in the number of head of cattle warrants the estimate that in a few years an export of at least 50 000 bullocks of an average weight of 400. kg will be reached. The excess production of sheep over the local consumption will probably allow of an annual export of about 50 000 to 200 000 sheep. Lastly, the uninterrupted development in pig breeding warrants an estimated export before long of 50 000 pigs, of 100 kg. each a year.

The author deals successively and in detail with cattle, sheep (as regards wool it is customary to classify Moroccan wools in classes decreasing in value: "aboudia" "urdighia", and "beldia"); goats (there were 1 268 000 in Western Morocco and 300 000 in Eastern Morocco in 1917), pigs, horses (closely resembling the Barbary horse), and mules. He deals next with the products of Moroccan live stock; skins (2 500 000 kg. a year), and wool (2 588 855 kg. exported in 1917).

POULTRY-REARING. — The climate of Morocco appears to be more suitable for rearing poultry than that of Algeria and Tunis. Morocco exports annually from 3 000 000 to 4 000 000 kg. of hens eggs.

804 — **The Development of French Guiana and the Employment of Penal Labour to this End.** — MICHEL, A. in *Colonies et Marine* Year III, No. 5, 1 p. 374-392 | 61 later: Paris, June 1, 1919.

French Guiana contains considerable wealth and immense resources; but this old colony, which is the penal colony of France, has not enjoyed a good reputation in that country and has not received the same attention

(1) The question of live stock in Morocco has been specially dealt with in an article by M. E. MÉRÉF entitled "Les possibilités agricoles du Maroc", abstracted R. April 1910 No. 412. (Ed.)

from the metropolis which other French colonies have had, so that its development is backward compared with all other colonies of France.

The climate and the soil of Guiana are particularly favourable to agriculture; vegetation is exceptionally rich and the cultivation of colonial crops on a large scale could be taken up there with a certainty of success.

However, gold mining has killed agriculture in Guiana. In 1855 gold deposits were discovered on the upper part of the river Approuague. In 1856 the export of gold was 8 kg. and it rapidly increased to 4855.87 kg. in 1894: in 1914 it was 1424.8 kg. in 1915, 3235 kg., in 1916, 2237.600 kg, and in 1917, 2847 kg. Guiana can produce much gold: it can also yield silver, copper, lead, iron, tin and quicksilver.

The author gives the history of French Guiana and deals successively with questions of forest produce, gold production and agricultural produce. He demonstrates what a fine future Guiana might, and should have if France does as much for it as for her other colonies. He points out that penal labour might give very appreciable results in spite of all that is said and indicates what should be done to obtain the maximum return (especially that work should be paid for, as was done before the decree of September 4, 1881).

80. — **Rice, Olives, and Citrus Fruits in the Argentine.** — I. SHINSUKE ITO, G. El aroz, Desarrollo y porvenir de la industria en la República Argentina, *Boletín del Ministerio de Agricultura de la Nación*, Year XXIII, No 1, pp. 3-123, + 47 Fig. Buenos-Aires, January-December, 1918. — II. VALLJO, C. El cultivo del olivo en la República Argentina, *Ibid.*, pp. 121-147, + 1 Plate. — III. RIVEROS, L. Citrus cultivados en el Chaco *Ibid.*, pp. 156-160.

I. RICE. — In 1915 the Argentine imported 21 904 t. of paddy and 25 418 t. of polished rice; during the agricultural year 1915-1916 there were 7 500 hectares under rice, which yielded 9 100 metric tons (an unfavourable year).

The author deals in a general manner with the following points: Classification; Selection; Varieties (those chiefly cultivated in the Argentine are: — Kinshú, of Japanese origin; Bolita chico, imported from Bolivia; Criollo blanco, late, attains a height of 1.80 metres; Criollo colorado; Salteño colorado; Vialone nero, imported from Italy in 1912; Bolita grande; Valenciano); Climate; Soil, Manure; Adverse conditions; Cultural operations commencing with the selection of the seed up to the harvesting of the crop; Legislation dealing with the cultivation of rice and State aid; Results of experimental cultivation of rice; Cost of cultivation; Dressing paddy, etc.

II. OLIVE. — The Argentine Republic imports annually about 22 million kg. of edible oil, including 8 million kg. of cottonseed oil. In 1917, 12 million kg. of olive oil were imported from Spain. The olive tree was introduced into the Argentine at the time of the conquest; it found there such favourable conditions and propagated there so rapidly that the Spanish Government fearing competition with the mother country, ordered the destruction of all the olive trees in the New World. At Arauco (Rioja) there is an ancient olive tree measuring 13 m. in girth;

this giant is one of the few trees that escaped destruction, and it is certainly the father of the olives in the whole of that region. At the present time the olive grows there extremely well and a commencement is being made in the extraction of oil by primitive methods. The author describes the improved methods followed in modern oil factories.

III. CITRUS FRUITS. — In 1918 there were in Chaco 38 827 orange and mandarine orange trees; it is estimated that there are now about 52 000 more, and lemon and Seville orange trees are also grown. Chaco is admirably suited to the cultivation of citrus trees, which grow very large and yield abundant crops, an orange tree producing 1 500 to 5 000 and even 8 000 oranges there. Of diseases and enemies are to be noted gummosis and the scale insect, *Mytilaspis citricola*; up to date this latter has not caused much damage.

RURAL HYGIENE

806 — Duck Breeding and the Destruction of Larvæ of the Anopheles Mosquito. —

CHEVALIER, A., in the *Bulletin agricole de l'Institut scientifique de Saigon* Year I, No. 5, p. 157 Saigon, May, 1919.

The author recalls the experiments and observations of Mc ATEE, W. LOCKWOOD and S. G. DIXON (1) on the part played by ducks in the destruction of mosquitos and their consequent utility in the struggle against malaria.

This method of fighting against fever is specially recommended in Indo-China where duck breeding is already very prevalent but often localised in densely inhabited places. This bird should also be introduced into the most unhealthy regions (Central Tonkin, Eastern Cochin — China, etc.). The Chinese of Cholon practise duck breeding with the help of very ingenious incubators.

As soon as they are hatched the ducklings wander over the pools and feed not only on the larvæ of insects and small aquatic animals, but also on algæ, duckweed, *Salvinia Azolla* and other small aquatic floating plants, which are in fact cultivated for this object in the deltas of the Mekong and Red River in ponds maintained near habitations. No doubt the transformation of marshes into similar ponds for duck breeding in parts of Indo-China which are still scantily populated would give good results from a sanitary point of view.

807 — The Control of House Flies by the Maggot Trap; Experiments in Maryland, United States. —

CORY, E. N., in *The Maryland State College of Agriculture, Agricultural Experiment Station, Bulletin* 213, pp. 103-126 + 12 Fig College Park, Md., February, 1918

The results of three years' work at the Maryland Experiment Station in collaboration with the United States Bureau of Entomology.

In order to catch the larvæ of the house-fly, a specially constructed manure pit was used. First, a concrete floor was prepared 22 ft. × 12 ft. Around this floor was a rim, or wall, of concrete 4 inches high and 4 inches thick. An outlet pipe 4 inches in diameter was fitted into one corner

(1) *See R.*, April 1915 No. 515, (Fd.)

towards which the floor sloped a little, so that the water could run out easily. The pipe outlet (which could be stopped with a plug of wood) led to a small concrete cistern. A wooden platform, 20 ft. \times 10 ft., supported on legs 1 ft. high, was constructed on the basin. The framework of the platform was made of 2 \times 4-inch studding. There were 6 of these pieces running lengthwise 2 ft. apart, and supported on 4 legs set at intervals of nearly 7 ft. Across the top of the framework, were nailed at a distance of 1 inch apart, strips 10 ft. long by 1 $\frac{1}{4}$ inches thick and 1 inch wide. Upon this platform was placed the manure. Two platforms with a common cistern for the liquid manure can also be constructed. A platform of the above dimensions will contain the manure production of three horses for a little over two months.

Each day, after the addition of manure and litter, the heap was sprinkled with enough water to moisten it thoroughly without causing any leaching. Water was run into the concrete basin below the platform, so that the floor beneath the manure was covered to a depth of $\frac{1}{2}$ inch in the shallowest part. Larvae migrating from the manure in order seek a place where they could pupate, fell into the water and were drowned.

In the author's experiments, the larvae were counted at least once a week. The average number destroyed in this manner during three years was 95.8 per cent. The reduction in the number of flies in 1914 amounted to 76 per cent., but fewer were destroyed in the next two years.

The close packing of manure, the watering of the pile, and the return of leached materials to the heap tend to preserve the fertilising power of the manure.

The labour involved by this special pit is only slightly greater than that required to make an ordinary dung heap. The difference is in the time required to water the pile daily, and to clean the basin once every two or three weeks.

The saving in fertiliser and the destruction of a large percentage of flies will more than repay the cost of construction and operation.

808 - **The Curative Action of the Cinchona Alkaloids on malarial fever.** — MARCCHOUX, E., in *Bulletin de la Société de Pathologie exotique*, Vol. XII, No. 6, pp. 307-309. Paris, 11 June, 1919

GIEMSA and WERNER have pointed out the superiority of *dihydroquinine* to quinine, BOURRU has studied the advantages of *quinmethyle*; GIEMSA and WERNER confirm the experiment of BOURRU, placing great value on quinine and hydroquinidine and not recognising any in cinchonine and hydrocinchonine. O. PEIPER and BAERMANN recommend hydroquinine. In India, MAC GILCHRIST has studied the action of hydroquinine and that of various cinchona alkaloids in which he recognises a therapeutic value equal to that of quinine.

The author has found that quinidine and cinchonine in doses of 1 gm. act on the *schizonts* of *Plasmodium vivax*, which appear disordered and broken up 8 hours after administration. Both, as does quinine, prevent return of the attack. Hydroquinine and hydrocinchonine in doses

of 1 gm. have the same property. The *schizonts* of *P. vivax* are destroyed by a single dose of 0.50 gm. of hydroquinine. In doses of 1 gm. the total alkaloids of cinchona act as well as quinine.

At a time when, in addition to the colonial consumption, there is such demand for cinchona in Europe for the treatment of the malarial soldiers in the armies of the East, and when the price is so high, the author has brought to notice results which enable considerable economy to be made, since they show that it is possible to extract from cinchona bark 10 to 15 % of active matter in place of 5 %.

809 - **Food Value of Asparagus.** — JUQUELIER, P., in *thé Industrie Française de la Conserve*, Year V, No 8, pp 137-140. Paris, June, 1919.

Asparagus shoots contain only a small quantity of carbohydrates. The mean results of numerous chemical analyses indicate a percentage composition of: — Water 93.32; nitrogenous matter 1.98; fats 0.28; carbohydrates; 2.74 — mineral matter 0.54; cellulose 1.14 %.

According to ALQUIER the elements of asparagus that are really utilisable, that is to say those which are digested, are generally confined to nitrogenous matter 1.61 gm. — fats 0.14 gm — carbohydrates 2.11 gm. — mineral matter 0.48 gm. out of 100 gm. of raw material.

To express more concretely the nutritive value of asparagus it can be compared quantitatively with other vegetable foods eaten daily as follows — it is found that 100 gm. of asparagus is the equivalent of 16.46 gm. of potatoes — 35.95 gm. of peas — 74.27 gm. of artichoke bottoms — 85.46 gm. of lettuce. On the other hand 100 gm. of each of the following vegetables furnish calories. potatoes 69.35 — fresh peas 37.66 — artichoke 18.16 lettuce 15.80 asparagus 13.51.

It is seen from these few figures that asparagus cannot in any way be considered as a really nourishing dish, contrary to common opinion, and that very large quantities would have to be ingested to obtain a ration of appreciable value. Further, there is no substance found in sufficient proportion in asparagus which would warrant its being regarded as a food capable of giving special benefit in maintaining the system. Asparagus is not a plastic food since the total of the ternary constituents which it contains is less than 3 %.

The mineral substances which make up its ash are formed largely of acetate and phosphates of potash, but these are not worthy of notice either on account of their quantity or their assimilability.

In order to give asparagus a certain value in diet it is therefore necessary to fall back on the sauce, as is generally the case.

810 - **Digestibility of Protein Supplied by Soy-bean and Peanut Press-Cake Flours; Experiments in the United States.** — HOLMES, A. D., in *U S Dept. Agric. Bulletin*, No 717, pp 28 Bibliography of 22 Publications. Washington, Sept. 25, 1918.

The writer first gives a detailed summary of the literature dealing with the digestibility of common legumes; the source and available supply of soy-bean and peanut press cake; the factors considered in determining the food value of a protein; the amino-acids supplied by soy-

bean and peanut proteins as compared with those furnished by common cereal proteins.

The experiments referring to the last two questions proved that the soy-bean and pea-nut are very rich in lysine and tryptophane, and contain a protein of greater dietary value than the principal proteins found in ordinary cereals, or many common legumes.

The writer subsequently describes the experiments he carried out on 7 normal men for the purpose of determining the digestibility of the proteins of the soy-bean and peanut when consumed as part of a mixed diet.

The soy-bean flour was prepared by pressing the cakes twice (the cakes retained about 8 per cent of oil) and then grinding them and passing them through a sieve. Usually, peanut cakes are made of shelled, but not decorticated, nuts (the thin red skin surrounding the kernel not being removed) and contain fragments of the shells. Such a commercial press cake, although suited for a stock feed, is not fit for human food. On the other hand, it becomes an excellent article of diet if, before pressing, the shelled peanuts are blanched by subjecting them to an atmosphere of live steam to loosen the skins, and then agitated in a container with a suction blower, so as to separate the skins from the kernels.

The peanut flour used by the author in the first series of experiments was made from blanched roasted peanuts, that employed in the second series, was prepared from shelled raw peanuts from which the skin had not been removed.

The soy-bean and peanut flours were made into biscuits and supplied nearly all the protein of the diet. On an average, 85 per cent. of the soya protein and 86 per cent. of the peanut protein were digested, which was a large amount.

The writer considers that soy-bean and peanut flours, being rich in proteins that are very digestible and of high biological value, should prove valuable additions to the human dietary.

811 - Bread-Making with Lime Water; its Interest from the Point of View of Colonial Hygiene. — LAHILLE, A., in the *Bulletin de l'Institut Scientifique de Saigon*, Year I, No. 5, pp. 136-141. Saigon, May, 1919.

Bread-making with lime water, which was so much practised in France during the war (1) has a special interest from the point of view of colonial hygiene. In the greater part of the colonies only traces of lime are found. Vegetables used for food and drinking water are very slightly calcareous. Compared with Europe colonial food is very deficient in lime. According to the calculation of the author the deficiency of carbonate of lime per day for grown up people is about 0.35 gm. to 0.40 gm. Certain nutritive disorders due to this more or less affect Europeans and are too readily attributed to the climate. Children are still greater sufferers from this want of lime than adults; their growth can be consi-

(1) See R., Nov. 1917, No. 1070; Jan. 1918, No. 3; Feb. 1918, No. 216 and March 1918, No. 243 and 344. (Ed.)

derably hindered. The introduction of lime, a mineralising agent of the first rank, into the system is to be recommended, and one of the most convenient and pleasant means of absorbing it, is to incorporate lime water in bread of which it improves both the physical and organoleptic characters.

The author carried out experiments in bread-making with lime water at Saigon, and he gives a detailed account of them.

**AGRICULTURAL
INSTITUTIONS**

812 - Scientific Organisation of Agriculture in the Colonies. — WÉRY, G., in *Annales de l'Institut National Agronomique*, Second series, Vol. XIII, Part. 2, pp. 275-365. Paris, 1918.

France is the second great colonial Power in the world, she comes immediately after England. Her colonial empire, comprising 42 colonies, extends over an area of more than 10 million square km. inhabited by 40 million subjects of various races; the commerce of this empire amounted to three thousand million francs in 1913, about one third of the special commerce of France. Colonial questions are therefore of great interest for that country.

The scientific organisation of agriculture is necessary for the economic development of the French colonial empire and this question is studied by the author, who is Director of the "Institut National Agronomique".

The paper is divided into 3 parts. The first part is intended to demonstrate how scientific methods intervene in the progress of colonial exploitation of the soil; it enumerates and describes the research institutions. The author has attempted to demonstrate not only their utility, but their necessity, by furnishing concrete examples taken from the results already obtained at experimental stations and agricultural schools. He has easily proved his case with the records of experiments, now numerous, which agriculturists of various countries have already made, he has specially held up as examples the important work of M. BONAME in the Mauritius on sugarcane, of Messrs VAN BREDÁ DE HAAN and VAN DER STOCK in Java, and of Mr. and Mrs. HOWARD in India on rice.

The second part is devoted to the examination of what France and other nations have attempted up to date in favour of scientific organisation of colonial agriculture. This comparative study has naturally caused the author to express his wishes regarding French possessions: creation of research and demonstration institutions, schools of agriculture, organisations for the distribution of better plants, and so far as domestic animals are concerned, better breeding stock (1). Lastly, in a third chapter, the author gives papers on the institutions at present working in French colonies and in other countries.

(1) Important decisions have been made since the author wrote and numerous institutions have been created for organising, developing and increasing agricultural production in the French colonies. See on this subject *R.* Oct 1918, No 1068 (for Indo-China); *R.* May, 1919, No. 558 (for French West Africa), and No. 557 (for North Africa) (*Ed*)

813 - The Hill Station of Hon-Bà, Indo-China. — YERSIN, A. J. E., (Director General of the Pasteur Institutes in Indo-China) with preface by A. CHEVALIER in *Bulletin agricole de l'Institut scientifique de Saigon*, Year I, No. 5, pp. 129-135. Saigon, May, 1919.

Dr. YERSIN (formerly Assistant of Pasteur and collaborator of Dr. Roux) having been one of the first to popularise hevea planting in the extreme East, by founding the plantation of Suoi-Giao, attached to the Pasteur Institute since 1897, has established in 1918 a botanic garden in a beautiful group of mountains lying between the plateau of Lang-Bian and the sea, which he proposes to work as "The National Park of Indo-China", containing also a biological experimental station for the study of forestry and agriculture in tropical highlands. He has recently introduced there cinchona trees, cinnamon, fruit trees, etc.

It is hoped that Hon-Bà in a few years will become like the Station of Tjibodas, on the slopes of Gedeh in Java, where Dr. M. TREUB founded a branch of the botanical garden of Buitenzorg about 25 years ago.

Hon-Bà forms part of the Annam range from which, however, it is separated by deep valleys. It is a spur situated in latitude 12° north, about 30 km. as the crow flies from Nhatrang and the sea coast. Its altitude is 1500 to 1600 m. The station is at 1500 m. on the crest of the mountain.

The soil is granitic and of very old formation. The climate, from the point of view of mean temperature which is 17.10°C., is approximately the same as that of Nice (15.70°C), Ajaccio (17 60) and Algiers (18 10) with smaller differences between summer and winter; in 1918 the lowest temperature, observed on the 15th January, was + 6 50 and the highest, recorded on July 22, was + 26 40 C

M YERSIN gives details of the flora and fauna of Hon-Bà, of the installation of the Station and of the work done and undertaken there. The principal object of the Station of Hon-Bà is to transform this fine mountain country into a national park for Indo-China. The work will be carried out in close collaboration with the Scientific Institute at Saigon: it is sought not only to acclimatise at Hon-Bà those species which are interesting economically, but also to bring together a botanical collection of trees and ornamental plants, both Indo-Chinese and exotic, which find the soil and climate favourable to their growth.

It is hoped that some time, not far off, Hon-Bà may be joined to Lang Bian by a road which will allow tourists to visit this wonderful country.

814 - Proposal for the Foundation of an Experimental Station for Saharan Crops and of a Biological Research Station in the Sahara. — TRABUT, in the *Bulletin agricole de l'Algérie-Tunisie-Maroc*, 2nd Ser., Year XXV, No. 5, pp. 109-116. Algiers, May, 1919.

Since 1912 the Director of the Southern territories recognised the necessity of creating a "Research Station having for object the better utilisation of the Sahara region". Charged with the work of drawing up a scheme and finding a site, the author, at the end of 1912, visited the Biskra region and could not find there suitable land for the proposed expe-

perimental Station, the available areas being insufficient or presenting unfavourable conditions.

During the early part of the war the project remained in suspense in spite of the large provision made for it in the budget of the Southern territories (50 000 francs). Profiting by the facilities afforded by the new Biskra-Tougourt line, the author in 1918 found a suitable site on the railway line. It is between Mazer and El Berd that an important centre of cultivation should be started between the railway and the salt-marsh (chott) of Djamaâ for a length of 12 km.

The salt-marsh, on ground sloping from south to north, is drained by the river Kherouf into the Mourguedine chott and the difference in levels is such that it will be easy to drain it, to remove the salt, and to cultivate part of it under date palms or at least with halophytes capable of feeding animals for producing manure needed for the area planted with date palm.

The site chosen for the station includes a variety of soils, especially sandy parts which can be used for experiments on a whole series of plants which can live on such soil. The buildings are to be erected at Arhfiane near the future railway station. There also will be arranged quarters for the natives who will cultivate the proposed oasis. The well-aerated station of Arhfiane appears to offer hygienic conditions for the establishment of an important centre. A laboratory of biological research would be attached to the experimental Station for Saharan agriculture. This laboratory would be even better placed at Tougourt.

The programme of research to be undertaken is extensive and should however be completed later: the date palm is to be the principal object of research. The author indicates what varieties of date palm should be introduced (seedlings of good varieties are to be produced on a large scale in order to obtain good strains), and deals successfully with the multiplication of date palms, their fertilisation, and cultivation, the diseases and parasites which attack them, the ripening, preservation and packing of dates, Saharan agriculture (a lujube tree bearing large fruit recently introduced from China, vegetables, fodder plants, cotton, henna, etc.), stock-breeding.

CROPS AND CULTIVATION

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

- 815 - A Field Study of the Influence of Organic Matter upon the Water-Holding Capacity of a Silt-Loam Soil. — ALWAY, F. J., (Chief of Division of Soils), and NELLER, J. R. (formerly Assistant in Soils, Agricultural Experiment Station of the University of Nebraska), in the *Journal of Agricultural Research*, Vol. XVI, No. 10, pp. 263-278, + 2 fig. + 1 pl., Bibliography of 12 Works Washington, March 10, 1919.

There exist very few data as to the influence of organic matter upon the water-holding capacity of soils. The investigations of the writer have contributed to our knowledge of the subject. His paper reports a detailed study of the moisture conditions of two adjacent plots at the Minnesota Experiment Station. In both plots, the soil was a silt loam, very uniform

in texture, but differing widely in content of organic-matter, as the result of great differences in cultural treatment. During the cool wet summer of 1915, the surface foot, and this alone, showed a very marked difference in moisture content, especially in available moisture, the soil which was the richer retaining the most water. In the warmer and somewhat drier summer of 1918, however, when winter rye was grown, much smaller differences were found.

It is therefore concluded that, in the case of a finer textured soil, with a fine-textured subsoil, and a comparatively level surface, the differences in the water-holding capacity that may be caused by differences in manuring, or in cultural operations, exert but little influence upon the productivity.

816 - Solubility of the Lime, Magnesia and Potash in such Minerals as Epidote, Chrysolite and Muscovite in Soil. — GARDINER, R. F. (Soil Scientist, Bureau of Soils, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. XVI, No. 10, pp. 259-261. Washington, March 10, 1919.

While experiments relating to the solubility of the lime, magnesia and potash of various silicates have frequently been carried out, especially by means of a saturated solution of carbon dioxide, there seems to have been relatively little work done upon the degree of action of soil extracts upon the lime, magnesia and potash present in epidote, chrysolite and muscovite, — minerals commonly found in soils. The writer took from 0.1 to 1.0 gm. of finely-ground epidote and chrysolite, and from 0.1 to 0.4 gm. of muscovite, and left them for two months in contact with 25 cc. of soil extract at a temperature of 25° C. He found that, on an average, 1.6 % of the total lime of the epidote, 0.21 % of the total magnesia of the chrysolite, and 11-21 % of the total potash of the muscovite were dissolved in this manner.

817 - Influence of Salts on the Nitric-Nitrogen Accumulation in the Soil. — GREAVES, J. E. (Chemist and Bacteriologist), CARTER, E. G. (Assistant Bacteriologist), and GOLDTHORPE, H. C. (*Idem.*, Department of Bacteriology, Utah Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XVI, No. 4, pp. 107-135 + 5 Fig. + Bibliography of 13 Works. Washington, January 27, 1919.

The purpose of this investigation was to determine the relative toxicity of various substances found in or applied to a soil, as measured in terms of bacterial activities of the soil, as well as to determine the stimulating influence of various substances upon bacterial activity, and the manner in which it is exerted. The soil used was of a sedimentary nature (sand and silt) in which all the elements of plant food were present in abundance with the exception of nitrogen, of which the amount did not exceed .15 %. The said soil, after being air-dried, was divided into 100 gm. portions to each of which 2. gm. of dried blood was added. The salt whose action was to be studied was added from a carefully standardised stock solution and the moisture content made up to 20 per cent by the addition of distilled water. The samples thus prepared were incubated at 28°-30° C. for 21 days; the nitric nitrogen was determined by reduction with iron and sulphuric acid, and the ammonia then distilled.

The salts studied were: the chlorides, nitrates, sulphates, and carbonates of sodium, potassium, calcium, magnesium, manganese and iron. The toxicity of these salts was found to depend upon the specific character of the salt itself, and not upon the ions. In descending order, the toxicity was as follows: — Sulphate of sodium, carbonate of sodium, carbonate of calcium, sulphate of potassium, carbonate of potassium, ferric nitrate, nitrate of sodium, sulphate of magnesium, ferric sulphate, nitrate of calcium, nitrate of potassium, chloride of potassium, nitrate of magnesium, manganous carbonate, manganous chloride, manganous sulphate, ferric carbonate, chloride of magnesium, nitrate of manganese, ferric chloride, carbonate of magnesium, chloride of sodium, chloride of calcium, and sulphate of calcium. The toxicity increases with the concentration, but in certain cases more rapidly than in others.

The commonest soil alkalis are very toxic to the nitrifying organisms, and greatly reduce the nitric nitrogen accumulation. In the concentrations tested, however, most of the salts acted as stimulants. The only salts which did not act thus were sulphate of sodium, carbonate of sodium, carbonate of calcium, sulphate of potassium, carbonate of potassium and iron nitrate. Chloride and sulphate of calcium increased the nitric-nitrogen accumulation of the soil 67 and 97 per cent respectively. On the other hand, the nitrates in some concentrations caused loss of nitrogen, and in others, the fixation of nitrogen. Nitrate of manganese proved the strongest stimulant.

The ammonifying powers of a soil containing alkalis are a better index of its crop-producing capacity than the nitrifying powers; but those compounds which are the strongest plant stimulants are also the most active in increasing the nitric-nitrogen in the soil, and it is very likely that the effect upon the plant is due mainly to the action of the chemical compound upon the bacteria which in turn render available more plant food. It should also be noted, that, though many of the nitrates caused large losses of nitric-nitrogen, this was due to their stimulation of species of bacteria which transform nitric-nitrogen into protein nitrogen, and was not the result of denitrification.

818 — **Fluorine in Soils, Plants and Animals.** — STEINKOENIG, L. H. (Bureau of Soils, Department of Agriculture, Washington, D. C.), in *The Journal of Industrial and Engineering Chemistry*, Vol. XI, No. 3, pp 463-465. Easton, Pa., May, 1919.

The average fluorine content of soils is 0.3 per 1000; it is derived from the following minerals: biolite, tourmaline, muscovite, apatite, fluorite and phlogopite. Large quantities of fluorine may be expected in soils carrying large amounts of mica. The roots of the plants absorb the fluorine and transmit it to the animals consuming these plants. Animals also obtain fluorine from spring water (1).

(1) See: R. 1916 No. 628 — R. July-Aug.-Sept. 1919, No. 849. (Ed.).

819 - Nitrates, Nitrification, and Bacterial Contents of Five Typical Acid Soils as affected by Lime, Fertiliser, Crops and Moisture. — NOYES, H. A. (Research Associate in Horticultural Chemistry and Bacteriology) and CONNER, S. D. (Associate Chemist in Soils and Crops, Purdue University Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol XVI, No 2, pp 27-42 + 2 Fig - 9 Pl Bibliography of 26 Works. Washington, January 13, 1919.

An investigation dealing with the formation of nitrates in the soil, and with bacterial activities (as represented by the number of bacteria present), as well as with the correlation of these two factors under specific conditions of the soil.

Controlled greenhouse experiments were carried out upon five typical acid soils. In part of the experiments, the soils were fertilised with calcium carbonate, superphosphate and complete fertiliser, cropped to wheat and clover, and kept at optimum moisture content, while in the other part, the soils were unfertilised, uncropped, and kept respectively one-fourth, one-half, and fully saturated with water. The results obtained include crop yields, soil-acidity determination, nitrates in the soils when sampled and after incubation with ammonium sulphate, and also the number of aerobic, anaerobic and carbon-dioxide-surviving microorganisms present in the soil.

The amount of nitrates present, and the nitrifying power of the untreated soils varied with the organic matter and total nitrogen, rather than with the acidity of the soil.

Manuring tended to increase nitrification, but not to the same extent as calcium carbonate; but on the other hand, independently of the different treatments, the presence of growing clover kept down the nitrate contents of the soils.

The degree of saturation of the soils affected the nitrates present, and as a rule, more nitrate was found in soil kept one-half saturated with water than in soil kept one-fourth saturated. The soils that had been kept fully saturated with water for 10 months contained no nitrates, and formed none when incubated with ammonium sulphate. The ratio of nitrates present in the uncropped soils before incubation to the nitrates present after incubation shows that the nitrate content of these acid soils tends to reach an equilibrium, above which no increase is obtained without additional treatment.

The bacterial flora varied in the different soils, and no bacteria developed into colonies visible to the naked eye, as long as the plates were incubated in an atmosphere of flowing carbon-dioxide gas. Calcium carbonate additions increased the bacterial content of the soils. This increase was largely in the aerobic organisms. The use of a complete fertiliser produced but small increases in the number of bacteria. The degree of saturation at which the soil was kept changed the proportions between the aerobic, anaerobic and carbon-dioxide-surviving bacteria.

Cultures from soil samples that had been kept one-fourth saturate with water contained the largest proportion of organisms forming mould-like colonies. Under optimum moisture conditions, both with and without the addition of lime and fertiliser, the nitrates after incubation

varied directly with the number of aerobic bacteria. In general, the larger the aerobic bacterial content and the nitrifying power of the soil, the larger the crop yields, and these investigations show the reasons why it is worth while to adopt a system of soil improvement which includes the addition of lime, phosphate and organic matter. It is evident that soil-fertility investigations should include both the chemical and biological examination of the soil.

820 - **The Decomposition of Cellulose by an Aerobic Organism (*Spirochaeta cytophaga* n. sp).** — HUTCHINSON, H. B. and CLAYTON, J. (Rothamsted Experimental Station, Harpenden), in *The Journal of Agricultural Science*, Vol. IX, No. 2, pp. 143-173 × 3 Pl. London, April, 1919.

The processes leading to the decomposition of cellulose and related substances in the soil present many features of considerable theoretical and economic interest, in view of the enormous quantities of cellulose and its derivatives which, year by year, find their way into the soil in the form of plant residues and organic manures.

The writers have already discussed, in an earlier paper, the effect of supplementing the amount of readily decomposable matter in the soil (1); in the present paper, they confine themselves to the consideration of the processes whereby an inactive carbon compound — in the form of cellulose — becomes potentially active by its resolution into simpler compounds.

In order to demonstrate the presence of aerobic cellulose-decomposing organisms in Rothamsted soil, a mineral salt solution containing a small piece of filter paper was inoculated with about one grain of soil. This gave rise under aerobic conditions to the development of a filiform, twisted organism more closely resembling a spirochaete than a bacterium, to which the writers gave the name *Spirochaeta cytophaga* n. sp.

In older cultures, the filaments assumed an ovoid or spherical form and resembled spores. The optimum temperature of *Spirochaeta cytophaga* is about 30° C., but it fails to grow on ordinary culture media, as its development is inhibited by the presence of 0.25 % of peptone. It flourishes in a solution of nutritive salts containing cellulose and simple nitrogen compounds, such as ammonium salts, nitrates, amides, and amino-acids at low concentrations. All carbon derivatives, with the exception of cellulose, inhibit its development, but cellulose in any form is decomposed at 25-30° C., and gives rise to mucilage of a pectic type. When a culture of *Azotobacter* in mannite was added to a cellulose culture of this nature, the amount of nitrogen fixed was increased. The by-products of the action of *Spirochaeta cytophaga* are, in addition to the above-mentioned mucilage, a pigment related to the carotin group, and small quantities of volatile acids.

(1) See R. March 1919, No. 281 (Ed)

821 - **The Use of Explosives in Agriculture.** — I. BRUTTINI, A. Sull'uso degli esplosivi in agricoltura, in *L'Agricoltura italiana illustrata*, Year I, No. 4, pp 21-31, 12 Fig. Milan, April, 25 1919 — II. IDEM, Ancora sull'uso degli esplosivi in agricoltura *Ibid.* No. 6, pp 33-38, 7 Fig Milan, June 25 1919 — III. LARUE, P. Défoncements à la dynamite in *Le Progrès agricole et viticole*, Vol LXXII, Year 36, No. 27, pp 14-18, 2 Fig. Montpellier, July, 6 1919

ECONOMIC EXPEDIENCY OF THE USE OF EXPLOSIVES. — Some people hold that it is not economically possible to use explosives in agriculture. This may be true of the ordinary trenching of an entire area either superficially or into the subsoil, in which case a large quantity of explosive is required. But if the displacement of the soil is limited to narrow strips for scooping out ditches or small patches, for opening up holes, for planting trees, for digging out drainage pits or for extracting the stumps of trees, there is economic expediency in using explosives even if their cost is rather high.

AGRICULTURAL EXPLOSIVES — Of the very great number of explosives that are known a few only are suited for use in agriculture, for which purpose they should combine power and rapid expansion, be easily transported, easily preserved, easily handled and of moderate cost. It ordinary black mining powder, which is not powerful enough and which decomposes in moist soil, is eliminated, 3 kinds of explosive can be used in agriculture: dynamite and other explosives derived from nitroglycerin; explosives made from chlorate of potash or perchlorates; safety explosives from nitrate of ammonia. Dynamite which explodes also under water is very useful in wet ground. Ordinary low standard dynamite containing 20-25 % of nitroglycerin does quite well for agriculture. Chlorate of potassium and perchlorate of ammonia powder, which are very violent, can be used for breaking up a rocky sub-soil or for blasting big rocks scattered over the surface of arable ground, but they do not suit ordinary ground or tree planting. The author considers that nitrate of ammonia explosives can be used in agricultural work because they are very safe.

PRECAUTIONS FOR THE PRESERVATION AND USE OF EXPLOSIVES. —

(1) The magazine should be well closed, dry, airy and not too warm: a magazine in re-inforced concrete is very suitable; the walls should be about 15 cm. thick and the roof 7.5 cm.: inside there should be no exposed metal in the walls.

(2) Boxes containing explosives should not be opened in the magazine but should be taken some distance away and only opened when required for use. If the covers of the boxes are not secured by screws they should be opened with wooden wedges.

(3) Dynamite cartridges should be kept in a horizontal and not in a vertical position because, in the latter case, the nitroglycerin would collect at the bottom and part of it would easily escape (sweating) and would be dangerous.

(4) Detonators should never be kept together with explosives.

(5) When handling explosives neither smoking nor lighted lamps should be permitted. Work with explosives should be done by day

(6) Sawdust which may get into detonators should be removed by

shaking them gently: pointed iron or metal instruments should never be used for this purpose. Detonators should not be attached to the cartridges until they are to be used.

(7) Explosives should not be left long in the sun.

(8) Dynamite should be handled as little as possible because it often causes bad headache.

(9) For tamping the charge in the holes a wooden tamper should always be used, never an iron one. The first part of the tamping (sand, tow, clay, etc.) should be slightly compressed, the upper part more tightly packed.

(10) Do not be too economical over the length of fuse, as it burns at the rate of about 60 cm. a minute.

(11) Two different kinds of explosive should not be placed in the same hole.

(12) If no explosion results do not go near before half an hour after the lighting of the fuse, if a fuse is used, nor before 10 minutes if the charge is fired electrically. In any case an unexploded charge should never be taken out, a fresh charge should be placed in a parallel hole 15 cm. from the old one.

(13) When an explosion occurs in ground which is not stony there is no danger even close by, since the external effect of the explosion throws fine earth a few metres high and around. But in the case of explosions in stony ground or for breaking up big rocks on the surface, the fuse should be long enough to enable the operator to get 200 to 300 m. away before the explosion takes place, or if the charge is fired electrically the button should be at the above mentioned distance.

CLEARING AND WORKING THE SOIL WITH EXPLOSIVES. — The principal uses of explosives in agriculture are (1) Clearing the surface or grubbing up the subsoil; (2) working bare or planted ground; (3) scooping out ditches; (4) opening holes in the subsoil for drainage in marshy ground; (5) stumping in dis-afforested land; (6) breaking up rocks on the surface.

There are further uses of an indirect character: — enriching the soil with fertilisers: destruction of moles, rats and insects infesting the soil, and of fungi injurious to plants, by means of poisonous fumes produced by explosions. The explosion causes a spheroidal cavity from which fissures radiate in all directions, but in clay soils, especially if they are very wet, the explosion throws particles from the centre into the pores of the surrounding ground and thus a cavity with hard compact walls is produced; the soil, instead of being reduced to fragments and fissured, is compacted and in worse physical condition than before the explosion. The use of explosives cannot therefore be recommended for wet clay soils.

Explosives disintegrate deep strata in all directions: they facilitate the work of farm implements and make the soil porous and absorbent to its greatest depths. In orchards explosives can replace deep digging if placed at suitable intervals between the trees.

Fissures in the soil facilitate the penetration of water and so in certain cases irrigation can be dispensed with.

The author notes results in various countries of the successful use of explosives in the preparation of fields, kitchen-gardens, vineyards, orchards and colonial plantations.

SCOOPING OUT OF DITCHES AND DRAINING. — Displacement of soil with the help of explosives makes it possible to scoop out ditches with simple labour with spade and shovel. In the direction which the ditch is to have, slightly inclined (25° to 45°) holes are bored 60 cm. to 70 cm. apart; the bottom of the bore should be 15-20 cm. above the bottom of the ditch that is to be made. A single dynamite cartridge is placed in each hole except the middle one in which 2 or 3 cartridges are placed. The central charge is fired and causes the others to explode. With a single row of cartridges in not too hard ground ditches 1.50 m. in width at the top, 0.90 m. at the bottom and from 0.90 to 1.50 m. in depth can be obtained.

With 2 or 3 rows of cartridges in parallel holes ditches 5 m. in width at the top and 1.50 m. in depth can be made.

A similar procedure is followed for making holes for planting trees. Explosives have proved very useful for draining marshy or wet land through the subsoil by breaking through to a permeable stratum.

BREAKING UP STUMPS AND ROCKS. — The most practical method of getting rid of stumps (especially big ones with strong roots) is by means of explosives. The charge is placed under the stump in a hole inclined at an angle of about 45° , at the point of greatest resistance and at a sufficient depth. Dynamite containing 25 % of nitroglycerin and of slow action is the best for this work. Trees may also be felled by surrounding the trunk with a girdle of cartridges. To calculate the amount of explosive required the English method is as follows; after calculating the square of the circumference of the stump this is divided by 3 if the tree has small roots, by 2 for trees well furnished with roots: no division is made in the case of trees with numerous very large roots. The quotient so obtained gives the number of ounces (1 ounce = 28.35 gm.) of dynamite (containing 25 % of nitroglycerin). On the other hand some experimenters have found that for similar stumps and in similar ground the quantity of dynamite varies with the square of the diameter of the stump.

Applying these two methods of calculation the author obtained the following data : —

Diameter of the stump.	Squares method Dynamite required gm	English method Dynamite required gm.
0.40	160	151
0.50	250	236
0.60	360	340
0.70	490	463
0.80	640	604
0.90	810	765
1.00	1 000	944

As can be seen the English method gives slightly lower results but there is sufficient agreement for practical purposes.

II. — Professor SOBRERO, the inventor of nitroglycerin, has experimented since 1878 in the use of dynamite for clearing land in Italy, especially in the Roman Campagna where the stratum of volcanic tufa ("cappellaccio") forming the subsoil can easily and efficiently be reduced to fragments.

Experiments in clearing land with dynamite were made some years ago on the land belonging to the monastery of the Tre Fontane near Saint Paul's, Rome, on behalf of the "Società Dinamite Nobel" of Avigliana. The same Company, acting with the Florence Forestry Inspectorate, is now experimenting in planting rocky ground at Monte Morello near Florence: other experiments in planting acacias and other trees in pebbly ground near the Company's works at Carmignano (Florence) have been successful.

III. Dr. LARUE agrees with Professor BRUTTINI in recommending that dynamite should not be used for ordinary trenching or in the cultivation of annuals. On the other hand he recommends its use for scooping out ditches and holes for tree planting and for splitting stumps. Operations relating to digging up the soil with the help of explosives succeed best when the ground is moist, i. e., in winter: those which have for object the upheaval of the ground (ditches, holes, stumping) succeed best when the soil is quite dry, that is to say at the beginning of autumn.

The author gives some technical details of the different operations and mentions some experiments also quoted by Professor BRUTTINI.

822 — Observations on Italian Dry-Farming (1). — JOVINO, S., in *Le Stazioni sperimentali agrarie italiane*, Vol. I, II, Part 3-4, pp. 125-192. Modena, 1919.

In Italian agriculture, "maggese" (fallow) in the strict classical sense of the word (*novalis* or *novale* in latin) consists in tilling the soil without making it produce any crop for an entire agricultural year. Afterwards this word has taken the larger meaning of cultivation for improving the soil, so that at the present time we discriminate between "maggese vestito" (green fallow) and the classic *novale* of Virgil which is called "maggese nudo" (bare fallow), "vacante", "vernile" or "primitivo".

At present the classic fallow with 4 successive ploughings, that is to say (1) "Rompitura" (clearing) carried out in winter; (2) "ristocatura" (about March); (3) "terziatura" (about May); (4) "arrusso" (in August) corresponding to the Latin words 1) proscindere; 2) iterare or efringere; 3) terziari or revertere; 4) lirare; is still practised without any change in the Tavoliere di Puglia (Apulia).

After a complete fallow follow 2 or 3 crops of autumn cereals in three or four-year rotation, or longer, according to the greater or less fertility of the soil; in the latter case a year or more of rest with grazing is interposed

(1) The first part of this work was summarised in R., May 1919, No 560 (Ed.)

The rainfall of one year affects the cultivation of the following year, as is shown by observations made by the author during the very dry year 1914: from the autumn of 1913 to the spring of 1914 inclusive, only 158. mm. of rain fell at Taranto (compared with a normal rainfall of 481 mm.) an amount scarcely sufficient for a crop of 5 quintals of wheat per hectare; now, the fields which had been tilled early and several times the preceding year produced 10-12 quintals of wheat per hectare, while on land where no superficial soft spongy layer (mulch) had been formed the wheat plants did not grow higher than 10-20 cm. and had to be grazed.

Generally wheat on tilled fallow produced more than wheat grown after hoed crops and the latter more than wheat grown on broken — up grassland.

Comparing the winter rainfall and the average winter temperature with the grain yield of the local kinds of wheat "carlantino" and "bianchetta", grown by Dr. N. STRAMPELLI during the 12 years 1906-1907 to 1917-1918 at the Experimental Station for cereals at Foggia on land previously treated as tilled fallow, the author draws the following conclusions:—

(1) The yield of wheat increases in direct proportion to the winter rainfall and inversely to the average winter temperature.

(2) The thermo-udometric period having the greatest influence on the yield is the winter.

If the agricultural and economic value of deep tillage on dry-farmed lands fully permeable to water and air is open to discussion, it is less so for Italian "aridoculture" where, owing to the presence of laterite and the greater proportion of clay, the ground is less permeable than that of North America.

The author quotes several examples of good economic results obtained by deep tillage, some farmers maintaining that the best season for carrying out the work is in the heat of summer, an opinion entirely opposed to the principle of "dry-farming" but tending to ascribe, in the farms of Puglia, the greatest importance to the extirpation of weeds. In this connection the author mentions the experiments which he made in the experimental farm of the Matera Professorship of Agriculture: they show that the effects of the extirpation of weeds last throughout several subsequent years. The three great agronomic effects of fallowing as practised in Italy, all three helping to economise the water required by vegetation, are:— extirpation of weeds; concentration of nutritive soil solutions; formation of a soft spongy mulch. The sanitary and social reasons for fallow and its persistence in the arid South of Italy (in spite of numerous examples of useful changes) are summed up specially in the prevalence of malaria which makes the country uninhabitable, and thus leads to a shortage of grass lands and stall feeding. The observations made by the author at the Matera experimental farm both in very dry years (such as 1913-1914) and in very wet years (such as 1915) often still more unfavourable, have led to the conclusion that:—

(1) In the South of Italy the application of farm yard manure to wheat, though useful in some respects, should be moderate.

(2) It is necessary to sow more thickly than in the "Far West" of America, that is to say 140-180 kg. per hectare (compared with 45-80 kg. in the "Far West"), for thin sown wheat in spite of abundant tillering, produces ears, fine on the outside, but empty, and they have less resistance to rust and to injuries caused by rapid thawing.

Hard wheats can be divided into 2 classes according to the colour of the episperm in perfectly ripe ears: —

(1) Red wheats; (2) yellow wheats, and each of these two classes comprise 2 groups, one of a single colour and the other with the addition of black. The class of red and red-black hard wheat belongs to the interior, that of the yellow and yellow-black hard wheat to the coast. Consequently, in hard wheat the red pigment is a xerophytic character while the yellow pigment is a halophytic character. The coast wheat is shorter than the wheat growing in the interior and has the blades less developed, which enables it to resist rust better.

In this connection the observations of the author show that in the South of Italy the most serious injury is caused by late rust attacking the wheat when in the ear. Now, the late wheats (Cignarella, Boschetti, Vilmorin) show the greatest resistance to rust: this apparent contradiction is explained by the feeble growth of the late wheat during the winter and until it forms the ear, which gives greater resistance to rust than that given by early formation of the ear and perhaps even by the quick formation of the ear. The result is that earliness protects wheat more against scorching ("stretta"), than against rust.

Taking as basis the climatic conditions and the yield of different kinds of crops in Apulia during recent years, the author shows that, in the arid parts of Italy, spring is a more critical time thermo-hygrometrically than thermo-udometrically and more in the coastal part than in the interior.

Factors affecting vegetation in Puglia are firstly the amount of moisture, and secondly phosphorus; this is why manuring with phosphates (heavily at intervals with slag or ground phosphorite: moderately, and repeatedly with superphosphate) is applied not only with the object of preventing rust and assisting fertilisation and fructification of the grain, but also to increase in every way the phosphatic minimum.

For the evolution of Italian dry-farming it is necessary to select varieties of wheat which withstand rust and drought, to study their special cultural requirements for a sufficiently long time under different conditions of climate and soil, to determine all the details of rational "dry-farming" of wheat and of other herbaceous plants which there is no question of suppressing in favour of arboriculture but on the contrary of placing them under experimental study.

The difficulties of Italian "aridocultura" cannot at present be met either by arboriculture on a large scale or by irrigation or by "dry-farming", but only by the ancient formula "grain, fodder, cattle", supported both by results acquired from local experience and those which scientific experiment will give. The author considers stall feeding, per-

manent settling on the land, drainage, medical ambulance service (for the treatment of malarial patients), and the sharing of profits (already practised in various ways on the Ionian coast), as indispensable measures of general utility.

823 - **Water Resources of Western Morocco.** — PENET, P., in *La Houille Blanche*, pp. 338-351, Paris, November-December, 1918, Summarised in *Annales de la Science Agronomique*. Year XXXVI, No. 4 6, pp. 219-220. Paris April-June, 1919.

PERMANENT
IMPROVEMENTS,
DRAINAGE AND
IRRIGATION

The author makes a rapid examination of some of the Great Atlas mountains in Morocco. He shows that the construction of reservoirs for irrigation would be difficult and would have small practical result. On the other hand the production of motive power would seem to be of interest in the places he visited. Irrigation might be greatly extended by means of "retharas" ("ketheras"), or underground canals, which are already much used where the natives are cultivating.

The author studies the agricultural use of water in the different agricultural districts of Morocco: the coastal zone has, he thinks, important supplies of underground water which show in the abundant springs near the sea on the edge of the plain of Chaouia, and by the great number of "dayas" (ponds); however, there is greater depth of underground water in Abda: on the other hand the alluvial plain of Sbou requires drainage.

The author reminds us that the ideal would be not to allow a single drop of fresh water to reach the sea from these regions.

In the region of Meknès-ze-Sefrou, an elevated plateau, irrigation corrects the irregularity of the summer rainfall. Perennial streams are numerous. The admirable distribution of water to the mills and fountains which are found in almost all the Arab towns in the district of Fez is described with interesting details: an ancient network of frail aqueducts is carefully organised under the care of ameens of the corporation of "gou-adsj" who are charged with the upkeep and clearing of obstructions in the conduits. It is wonderful to see such a delicate network work properly, at first sight, ignoring details, it appears too fragile. In the country inhabited by the Rehamna and by the Skharma and the plain of Taala the wadi Tessaout and El Abid are suitable for big works. As for the Oum-cr-Rbia it would be much reduced in its lower part if the judicious use of its upper waters is realised. The Tensift might also be utilised.

A monograph on the wadi Riraya, a torrent of the High Atlas, is included in the publication.

Finally a programme of survey, short but sufficiently detailed to enable conclusions to be reached, is considered necessary before undertaking work which might eventually prove useless.

824 - **Irrigation in Mesopotamia: Recent Developments.** — *The Times Engineering Supplement*. Year XIV, No. 526, p. 113. London, 1918.

The military conquest of the great delta of the Euphrates and Tigris has been speedily followed by the putting in hand of irrigation works, which in their main features follow the scheme prepared by Sir William

WILLCOCKS for the Ottoman Government in the years preceding the war, and the first section of which, the Hindia Barrage, was the subject of a contract made in 1911 and was completed in December, 1913.

Irrigation questions have always received attention in Mesopotamia, and the early beginning of the Christian era was distinguished for important canals which irrigated the country east and west of the Tigris. The ravages of war as well as neglect resulted in the destruction of many of these old works, and at one time the Euphrates dwindled to insignificant proportions, while the junction of the Euphrates and Tigris, which for many centuries was at Kurna, is now near Basra. Under Turkish rule more than one attempt was made to carry out irrigation works. About 45 years ago work on a barrage across the Saklawia branch of the Euphrates was put in hand, but it had the disappointing result of diverting the main stream into the Hindia branch and leaving the Hilleh channel practically dry. To provide a remedy for this condition of affairs the Ottoman Government endeavoured, by the construction of a weir across the Hindia branch at a point above the junction of the two streams, to refill the Hilleh channel. This project failed, partly by reason of lack of funds to carry out subsidiary works and partly owing to the silting up of the Hilleh channel. It was finally decided that Sir William WILLCOCKS, who then occupied the position of adviser to the Ottoman Ministry of Public Works, should report on the situation, and all that has since been done is the result of the extensive surveys which were then made (1).

The river delta comprises an area of some 12 000 000 acres, of which two-thirds is desert and one-third fresh-water swamp. The rainfall throughout this region averages about 8 in a year. The rivers are in flood during the spring months, when the flow in the Euphrates is estimated at 120 000 cu. ft. per second and in the Tigris at 180 000 cu. ft.; and Sir William WILLCOCKS reported that it should be possible, even without new reservoirs, to grow winter crops upon an area of 6 000 000 acres and to obtain summer crops from half that acreage.

The first work undertaken under the new régime was the repair of the old Hindia barrage, as well as the making of provision for carrying off the surplus flood water of the Euphrates. The important part of the scheme then authorised was, however, the construction of the new Hindia barrage across a new channel excavated parallel to the main stream for a length of 750 metres with a breadth of 268 metres. The new barrage, with the lock, extends across the whole width of the new channel, and a subsidiary dam with lock was also provided, 50 metres below the main dam. A diversion of the Hilleh branch was made and fitted with controlling sluice gates as well as a navigation lock, and the old channel of the Euphrates was closed by an earth dam.

It was intended to construct two barrages on the Tigris, one of which would have been near the ancient Nimrod's dam; but the whole of the reclamation work was suspended on the outbreak of war, and little or no advantage has been derived until now from the completion of the Hindia barrage owing to the absence of the necessary branch canals, some of which were to have been provided by the repair of the old system, which

(1) See: — G. A. R. BORGHESEANI *L'irrigazione in differenti Stati e colonie Commissioni Reale per studi e proposte relative ad opere d'irrigazione, II Relazione, 3ª Parte* Bergamo, 1910 — R 1914, No 414 (Ed.)

had fallen into disuse, while others were to have been new constructions. Although the estimated acreage which has now been put under cultivation falls far short of the figures mentioned in Sir William WILLCOCKS's report, nearly 100 of the old canals on the Hilleh branch have been repaired; and 30 000 acres have been brought under cultivation.

It is mainly below the barrage that repair and construction of the canals has been carried out, but the new works, which have engaged the services of about 14 000 Arabs, have enabled land to be cultivated above the barrage as well as down-stream. The preservation of the country from the effect of floods and the harnessing of the water available is naturally the first work which has been undertaken, but serious consideration may perhaps be given at an early date to the construction of the two barrages on the Tigris included in the Willcocks scheme, which, with auxiliary works, are estimated to cost about £6 000 000.

825 **Utilisation of Street Sweepings and the Droppings of Animals at Trieste.** — TAMARO D., in *Il Coltivatore*, Year 65, Nos. 15-16, pp. 324-326. Casale Monferrato, May 30-June 15, 1919.

MANURES
AND MANURING

Trieste, a city of over 200 000 inhabitants, collects daily 90 tons of sweepings. In view of the difficulties of transport caused by the war and of the great scarcity of manure, Ing. Pio SAULI, of the technical Bureau of the municipality, conceived the idea of enriching part of the sweepings by mixing them with the dung of horses and other animals collected daily in the streets of the city, so as to obtain a compost which was sold at 20 crowns (21 fr. at par) per ton at the shipping wharf.

The remainder of the sweepings, after having been roughly separated from pieces of glass, tins, and similar objects, was incinerated in continuous furnaces alight, composed of 3 batteries. During the 4 years of the war the average heat value furnished by the sweepings was 1 400 calories, which corresponds to $\frac{1}{5}$ of that furnished by good coal. The thermic power obtained daily was equal to that of a coal plant consuming 180 to 200 quintals of coal daily and gave an electric energy of 875 HP which was used to supplement the central electric station of the city.

The slag (vitrified ashes) taken from the kilns is immediately plunged while incandescent into water so as to yield a fragile mass more or less pulverised. After sifting, the finest part is used as manure; the coarser part is used for buildings of reinforced concrete and for making concrete bricks.

The fine slag has the following percentage composition; — Lime 40.5; Silica 18; Alumina 6; Ferric oxide 4; Magnesia 3.6; Phosphoric anhydride 1.03; Chlorine 0.26. It corresponds therefore to a tetraphosphate and can be used as an excellent phosphate of lime fertiliser: it has been sold to farmers at 3 crowns 3.15 fr. per ton.

To derive a real manure, Ing. SAULI added to the incinerator the "crematorio" that is to say the industry that utilises the bodies of animals, meat seized as unfit for consumption, the bodies of stray dogs, etc.: altogether 1 ton of such refuse is collected in Trieste daily.

The animals are skinned, cut in pieces and boiled in a autoclave. The products are fats used in soap factories, meat meal which is used for fattening (chiefly pigs), and as manure: the bones are broken, ground to powder, and used as manure; with the broth, which is very thick and contains much colloid and nitrogenous matter, is mixed powdered slag, the mixture is caked and sold as manure and contains 41 % of slag; 1.1 % of nitrogen; 1 % of phosphoric anhydride; 0.5 % of potash; it sells at 20 crowns a ton. To make this manure more nitrogenous, meat meal, which contains 8 % of fat; 56.97 % of organic nitrogenous matter; 20 % of ash, is added. The bone meal is not sold pure but is mixed with an equal part of slag: an excellent complete manure is thus obtained having the following composition: -- 13.13 % of organic nitrogenous matter 17.35 % of phosphoric anhydride; 9.84 % of silicates; 20 % of lime. The broth or the colloid liquids contains 43.69 % of animal nitrogenous substance, corresponding to 7 % of organic nitrogen. All these manures are very much in request, especially for kitchen garden use.

826 - Green Manuring with Perennial Vetch (*Vicia atropurpurea*) in the United States. — See No. 878 of this Review.

827 - The Origin of African Phosphates. — FAEREGA, P, in *L'Echo des Mines et de la Métallurgie*, Year XLVII, No 2628, pp 334-335 Paris, June 1, 1919

Information regarding the origin of oolitic phosphate beds in the north of Africa stretching from the Mediterranean to the Great Atlas.

The whole of the zone has been affected by the alpine movement, of which the folds, through the Apennines and by the Calabro-Sicilian arc, enter Northern Africa at Tunis and through the folds of the Spanish Penibitic range enter at Tangier-Ceuta, the two extreme arcs being united by the tectonic axis of the North African alpine movement constituting the southern spur of the great anticlinal of which the huge arc disappeared in the Pliocene age and produced the Western Mediterranean. Excluding the western region of the Great Atlas in Morocco and some zones in Spanish Africa where primary formations are met with, the entire area of North Africa, more than 1500 km in length by 300 km. in width, is almost entirely occupied by secondary formations, chiefly cretaceous, which in the form of a great basin lying east to west forms a bed to eocene strata, the residue from the disintegration of which indicates the extraordinary pluvial and fluvial erosion which has affected them. The nummulitic strata of the Suessonian group appear at Tunis and, with gaps due to intense denudation, extend in a westerly direction towards the mountains of Anghera to the south of Tangier where they curve to the north and connect, under the Straits, with the Spanish nummulitic formation of Cadiz and Malaga. The eocene strata are sometimes overlaid by miocene, and at certain places below the quaternary, volcanic rocks, rare to the east and north, become very abundant to the west, especially in the region of Melilla.

The tertiary earthy phosphates of Tunis and Algeria are found in the lower Suessonian. The average Tunisian analysis shows 60-68 % of

tricalcic phosphate, 12 % of carbonate of lime and magnesia, 1 to 2 % of iron and alumina, a little fluoride of calcium (sometimes 6 %), 6 % of silica and 4 % of water containing organic matter.

The beds of phosphates are met with interstratified with lumachel limestone. The deposits were formed on a sea shore or in a shallow sea ; they are of sedimentary or pseudo-sedimentary origin, marine organisms and chemical action of the sea having evidently helped in their formation. Moreover, after immersion the lower beds have been enriched by phosphate of lime dissolved by atmospheric water and brought down from higher beds ; in a similar manner deposits of flint have been produced simply as concretions of gelatinous silica dissolved by rainwater from feldspathic rocks, or from strata formed by organisms with silicious skeletons.

Phosphate is such an active substance that, when free, it combines with lime, forming rapidly porcelain-like concretions round the first particle met with ; if it is organic and is embedded in mud, the two catalytic forces unite, increasing the original microscopic spherula by successive layers, and giving the marly rock an oolitic appearance, and finally it may become an incoherent oolitic phosphate or bed of phosphate like those of Tebessa (Algeria), where the chief layer is 3 m. thick, or those of Gafsa (Tunis) where the 2 layers worked measure 3 m. and 2 m., if the phosphate of lime is sufficiently abundant, so that the spherical grains, developing and becoming compressed, are able to displace the mud or the earthy rock in which they lie. At the Metlaoui mine in the Gafsa deposit the total thickness of the phosphate beds is 7 m. in a formation of 27 m.

828 - Phosphate of Lime Resources in Egypt.— *The Board of Trade Journal*, Vol CII, No. 1167, p. 485, London, April 10, 1919.

Deposits of phosphates occurring as beds in sedimentary strata are widely distributed in Egypt. They are very similar in character to those of Algeria and Tunis, and present a field of considerable economic importance. The land now let under mining lease forms a very small proportion of the total area known to contain phosphates, so that there is ample opportunity for prospecting enterprise. The localities in which phosphate is at present being mined are : — The Safaja district near the Red Sea coast ; the Kossier district near the Red Sea coast ; and the Sebaia district on the east bank of the Nile. The production for the past nine years was as follows :—

Year	Metric tons	Year	Metric tons
1910	2,397	1915	82,998
1911	12,012	1916	125,008
1912	70,918	1917	115,732
1913	104,450	1918	31,147
1914	71,945		

The rock phosphate is either shipped raw in bulk or manufactured into a finished fertiliser, of which two kinds are at present made in Egypt, namely, "Ephos basic phosphate" and "Tetraphosphate"; these are exported in bags.

Prior to the war the greater part of Egypt's phosphate production was shipped to Japan, which took 75 565 tons in 1914. During hostilities the quantity exported has fallen owing to high freight rates and the impossibility of obtaining sufficient shipping for the purpose. In 1916, for instance, only 20 526 tons were despatched, of which 17 521 were divided between the United Kingdom and the British Colonies. The phosphate mines have, nevertheless, been kept working, though on a reduced scale, and the bulk of the output is now in stock awaiting shipping facilities.

The quality of the rock phosphate varies considerably and may be roughly divided into three grades:--

	Tricalcic phosphate	Iron and alumina
	Per cent.	Per cent.
(1)	10 0	3 00
(2)	64 0	2 75
(3)	70 0	1 50

The phosphate produced in the Nile Valley is the lowest grade, and is shipped from the port of Alexandria. The Red Sea districts produce the better qualities, which are despatched from the ports of Safaja and Kosier. Port Safaja is a deep-water anchorage, and has an installation for rapid mechanical loading.

Superphosphate has not yet been made in Egypt owing to the high cost of imported acid. The imports of superphosphate into Egypt have latterly been as follows:—

	Metric tons		Metric tons
1913	13 148	1915	7 056
1914	15 278	1916	3 250 (1)

829 - **Moroccan Phosphates.**—I. L. G., Moroccan phosphates, in *Le Phosphate*, Year XXVIII, No. 1282, pp. 106-117. Paris, March 15, 1919. — II. Moroccan phosphates and the Gafsa Company, *Ibid.*, No. 1283, p. 132. April 1, 1919.

There are in Morocco in the El Boroudj region (a small locality 140 kilometres to the S. S. E. of Casablanca) considerable deposits of phosphate of lime extending from west to east for nearly 100 kilometres between Dar Chafai and Wadi Zem. These deposits, discovered in 1912, were for eighteen months examined by means of trenches, galleries and shafts made by the Mines Department of the Protectorate. These works, which have at present only touched the deposits situated to the west of

(1) Cf. INTERNATIONAL INSTITUTE OF AGRICULTURE, *The International Movement of Fertilisers*, passim

El Boroudj, have shown the existence of a phosphate formation about 50 m. thick containing several beds (of which 2 are 5 m. and 8 m. thick and represent over one thousand million tons of phosphate).

That part of the deposits which is situated to the east of Boroudj (between this centre and Wadi Zem, for about 70 km.) has so far been the object of prospection which establishes the great probability of the continuity of the formation, clearly found at Wadi Zem to be of the same character as at El Boroudj. Work is to be undertaken on this eastern part during 1919.

Considerable deposits both in extent and quantity are therefore in question. The complete study of the averages of the different layers has not yet been finished but everything seems to indicate that the deposits are rich. The upper layer yields 65 % of phosphate and the regularity of the deposits, of which the larger are almost horizontal, with a slight dip of 4 mm. per metre towards the south east, warrants the hope of equal regularity in the phosphate content.

The public sale by auction of the El Boroudj deposits may perhaps be held in 1919.

380 - **Spitzbergen Phosphates.** — KABOT, C., in *La Géographie*, Vol. XXXII, No. 4, p. 252. Paris, 1918.

In Spitzbergen, according to the *Aftenposten* of Christiania, the working of the deposit of phosphates on Cape Thorsden in Isfjord has been resumed. In 1870, a Swedish company began working this deposit but had to close down shortly after. Last summer work was recommenced by Norwegians and the arrival at Bergen of a ship loaded with 160 tons of Cape Thorsden phosphates is announced.

831 - **Artificial Phosphatic Slag.** — BRUNO and RONNET, in the *Journal de la Société Nationale des Agriculteurs de Belgique*, Year I, No. 5, p. 70. Brussel, 1919.

During the course of their occupation the Germans manufactured artificial slag (1) at Obourg near Mons. The production corresponded with the maximum possible out-turn of a large factory of artificial Portland cement. These artificial slags were obtained by baking a mixture of silicate ore (phonolite) brought from Germany, together with a poor, chalky Belgian phosphate.

The greater part of the Obourg phosphatic slag was sent to Germany; a maximum of one fifth might be sold in Belgium.

The quantity recommended was 2 500 kg. per hectare; only part of the fertiliser acted during the first year. The best results were obtained with potatoes in sandy soil. The analysis gave 11.5 % of phosphoric acid of which more than half (6.5 %) was soluble in weak citric solution. It contained also 2.4 % of potash soluble in strong acid.

(1) See R. May 1919, No. 572 (Ed.)

832 — **Alsatian Salts of Potash.** — I. BEAUVIERE, J., *Revue d'Agronomie*, Second part, 5 Potash *Revue générale des Sciences pures et appliquées*, Year XXX, No. 13, pp. 411-412, Paris, July 15, 1911. — II *Communiqué du Bureau provisoire de Vente de la Potasse d'Alsace*. Mulhouse, July 10, 1919. — III BOUCROT (Member of the Parliamentary Commission on Potash), The potash question. *Bulletin de l'Association Italo-française d'expansion économique*, Year II, No. 11, pp. 29-30. Paris, May, 1919. — IV. MINISTÈRE DE L'AGRICULTURE ET DU RAVITAILLEMENT, Notice to Agriculturists regarding the Sale of Alsatian potash fertilisers. *Journal Officiel de la République française*, Year I, No. 4, p. 180. Paris, Jan 5, 1919. — V. N. On the subject of potash. *L'Energais*, Year XXXIV, No. 6, pp. 135-136. Lille, July 18, 1919.

I. In 1904, Vogt, an Alsatian prospector, searching for coal or oil in the forest of Wittelsheim to the north of Mulhouse, discovered a magnificent deposit of potash salts similar to those of Stassfurt. By 1906 Vogt had made 42 borings. The Germans went on boring and ascertained that the Alsatian deposit extended across the Rhine on the right bank of that river. In 1914 the deposit was divided into 4 groups: 3 German and 1 Franco-Alsatian. Of the 240 sq. km. marked out, the Germans held 180 and the French 60. The Germans had 42 millions of capital invested, Franco-Alsatians 40 millions and the Government of Alsace-Lorraine 7 1/2 millions. Only the German concessions were worked and produced only 200 000 quintals in 1913, against 12 million from Stassfurt.

An estimated value of 50 thousand millions is certainly not too high for the Alsatian potash deposits. When the war broke out the shafts sunk were almost all ready for exploitation and owing to the purity of the product they might have yielded in 1917 almost the same amount as central Germany, which considerably exceeded the French consumption. Measures have been taken since the beginning of 1919 to furnish French agriculture with as much Alsatian potash fertiliser as it needed, without administrative formalities. Already, during the early months of 1919, there was an output of 3 000 to 6 000 tons of Alsatian potash per week.

II. — The mines of potash salts in Alsace are situated in the plain of Upper Alsace between the villages of Wittenheim, Wittelsheim, Staffelfelden, Bollwiller and Ensisheim. The potash salts are found in two beds separated by 20 m. of rock-salt. The lower bed, the only one worked, is the more important and ceases at a varying depth of 450 m to 680 m.; it has a thickness of 2.5 m-5.5 m. over an area of 200 sq. km.

According to the estimates of official geologists this bed alone contains two thousand million tons of potash salts, equivalent to 300 million tons of pure potash, or several hundred times the annual pre-war world consumption. The two beds of Alsatian potash are composed of sylvinite, that is to say of a mixture of sylvine (chloride of potassium) pure and crystallised and of rock-salt (chloride of sodium). At present 17 shafts are worked and others are under construction, so that the annual production can be increased to 1 200 000 tons. These shafts furnish two qualities of salt of different value: crude sylvinite, or sylvinite (kainite) containing 19 to 25 % of chloride of potassium, and rich sylvinite (manure salt) containing 32 to 35 % of chloride of potassium. These two salts are placed on the market crushed but untreated: after factory treatment, required for

concentration, they attain a purity of 80 to 95 % of chloride of potassium and constitute commercial chloride of potassium. The tabular statement given below indicates concisely the average composition of the three salts :—

	Chloride of potassium (K Cl)	Pure potash (K ₂ O)	Chloride of sodium (Na Cl)	Sulphate of calcium (Ca S O ₄)	Insoluble
Silvinit (Kainite) . . .	19 to 25 %	12 to 16 %	60 to 66 %	2 to 5 %	10 to 12 %
Rich Silvinit (Manure Salt)	32 to 35	20 to 22	50 to 55	2 to 5	9 to 12
Chloride of potassium .	80 to 95	50 to 60	4 to 10	1 to 2	negligible

The following is the composition of rich sylvinite of Alsace :—

Chloride	{ of Potassium .	35 %
	{ of Sodium	51.58
	{ of Magnesium	0.18
Sulphate	{ of Calcium	2.78
	{ of Magnesium .	traces
Water .		0.70
Insoluble		9.76
Pure Potash (K ₂ O) .		20 to 22

III. — On the eve of the war, France and Germany cultivated approximately the same area : the former 24 million hectares, the latter a little less than 27 million. But the yield was very different. German soil produced, in the period 1910 to 1914, 21.3 quintals per hectare of wheat, while French soil only produced 12.9. Intensive use of chemical products explain this enormous difference.

In 1910, in the German Confederation, 486 million marks (600 million francs at par) was paid for 50 million quintals of fertiliser. Germany alone consumed 50 % of the world's supply of potash, while 25 % went to North America and the remainder to other countries. The quantity used per hectare is 7 kg. in Germany, 4.5 kg. in Belgium, 1 kg. in England and 0.5 kg. in France (1). Thus in the whole world 119 000 tons of potash were used in 1895 and 1 110 000 tons in 1913, or 10 times as much ; on the other hand during the same period the progress of German consumption was in the ratio 1 to 75, while that of the above mentioned countries was only in the ratio 1 to 24. The return of Alsace to France may reverse the position. Indeed, to give an idea of the importance of the exploitation expected for Alsace alone, the programme for 1922 is as follows :

Production : 500 000 tons of Potash (K₂O), or 2 400 000 tons of crude salts, 8 000 per day.

(1) According to the International Institute of Agriculture, *Production and Consumption of Chemical Manures in the World*, 2nd Ed. Rome, 1914 (Ed.)

Distribution of utilisable potash, proportional to the consumption in 1913, according to the traffic on railways and internal canals:—

France	40 000 metric tons
Italy	7 000
Switzerland	3 000
Total	50 000 (about)

There remain 410 000 tons for French ports or the Rhine:—

North America	300 000 tons
The Netherlands	40 000
Great Britain	30 000
Belgium	10 000
Scandinavia	30 000
Total	410 000 (about)

This programme would require the construction of 8 or 9 factories at a cost of 20 million francs.

IV. — The official sale prices are as follows, on truck at Mulhouse, loaded in bulk:

Kaïnite containing 12–15 % of potash (K_2O): 0.21 fr. per unit of potash.

Manure salts containing 20–22 % of potash: 0.265 fr. per unit of potash.

Chloride of potash containing 50 to 60 % of potash: 0.375 fr. per unit.

The invoice depends on to the strength in potash determined when leaving the sale office.

V. — The author notes the disadvantages of the present arrangements for the sale of Alsatian potash salts and proposes an arrangement with the “Kalisyndikat” regarding quantities and exports. He thinks that the representatives of the “Kalisyndikat”, are disposed to consider the ways and means which will enable the two great sources of the world's potash to realise normal and sure profits.

For the next two or three years the Alsace mines will be able to yield annually the above mentioned 500 000 tons of pure potash. With such a supply it would be possible, by means of well equipped and well directed advertisement, to double or treble French consumption while leaving plenty of scope for exportation.

833 — Research on the Fertilising Value of “Kallkalk”, a New Potash Fertiliser, in Sweden. — SÖDERBAUM, H. G., in *Meddelande, No. 163, från Centralanstalten för försöksväsendet på Jordbruksområdet*, Stockholm, 1918; summarised by CRISTENSEN H. R. in *Tidskrift for Planteavl*. Vol. 26, Part 1, pp. 186–187. Copenhagen, 1919.

A potash fertiliser is now sold in Sweden under the name “Kalikalk” (lime potash) which is made by crushing together felspar, limestone and gypsum, the mixture being then calcined at a temperature of 1150°C.

The author has tested the value of 3 samples of “Kalikalk” containing varying proportions of its ingredients. The potash (K_2O) content was between 5.4 and 5.8 %. Out of 100 parts of potash 74 to 98 were soluble

in 4 % hydrochloric acid and 52 to 71 % in distilled water. Besides potash, "Kalikalk" contains about 37 % of silicic acid, about 33 % of lime, about 10 % of clay, 8 to 10 % of sulphuric acid (SO_3), 0.75 to 2 % of magnesia, 1.75 % of soda, 0.20 to 1.75 % of oxide of iron. The fertilising value of the 3 above mentioned samples of "Kalikalk", compared with that of sulphate of potash, was tested on oats grown in glass cylinders containing about 9 kg. of peat mould very poor in potash. As fundamental fertiliser 13.5 g. of carbonate of lime, 7.26 g. of basic slag, 4.5 g. of Chile saltpeter, 1g. of sulphate of magnesium and 1g. of chloride of sodium were placed in each cylinder. The amounts of "Kalikalk" added were 1.5 g. and 2g. for each cylinder.

RESULTS. — On the whole the tests have shown that the potash in "Kalikalk" has an excellent fertilising effect, as was expected from the chemical analysis of this new fertiliser. "Kalikalk" had even a somewhat greater fertilising value than sulphate of potash and had a particularly good effect on the yield of grain. The respective fertilising values of the three different samples tested were approximately equal.

834 — **The Present Condition of Nitrogen-Fixation as regards Fertilisers.** — WHITE, A. W. (Lt. Colonel. Research Technical Division, Nitrate Division, Ordnance Department, Washington, D. C.), in *The Journal of Industrial and Engineering Chemistry*, Vol XI No. 3, pp. 231-237 + 3 Diagrams. Easton, Pa, March 1, 1919.

Fixed nitrogen in some form is an essential constituent of all the higher animal and plant organisms. Since gun-powder came into general use, fixed nitrogen in the form of potassium, sodium and calcium nitrates has been of prime importance in warfare. The ammonia resulting from the destructive distillation of coal has been recovered, and used in the chemical industry for more than a century. Free nitrogen forms nearly 80 per cent. of the air, but it cannot be utilised in this state, and though the chemist has known for many years how to combine this inert gas with other compounds in his laboratory, it is only within the last twenty years, that the fixation of nitrogen has been recognised as an industrial as well as a scientific problem. It was Sir William CROOKES who in 1898 called attention to the diminishing supply of Chilean nitrate and the possible famine that might ensue, as the result of the lack of nitrogenous fertilisers.

It is the first step in nitrogen fixation which is the most difficult. The nitrogen molecule, as it exists in the air, is very inert, and becomes active only at high temperatures, or in the presence of some activating substances known as catalysts which accelerate and facilitate the chemical reactions without, however, taking any part in them. The present industrial processes may be classified as follows:

1) *The Arc Process*, for the direct combination of the nitrogen and oxygen of the air to form nitric oxide, which subsequently by oxidation with air and combination with water forms nitric acid. For this process are required about 10.5 h. p.-years of electric energy per ton of nitrogen fixed as nitric acid per annum.

2) *The Cyanamide Process* involving:—

(a) The production of calcium carbide through reaction between lime and coke in an electric furnace.

(b) The interaction of calcium carbide and pure nitrogen at red heat to form calcium cyanamide.

(c) The decomposition of cyanamide by steam under pressure to form ammonia

(d) The oxidation of ammonia with air and combination with water to form nitric acid. The power required by this process is approximately 2.5 h. p.-years per ton of nitrogen converted to nitric acid per annum.

3) *The Aluminium nitride process*, in which the aluminium nitride is made from aluminium oxide, coke, and nitrogen heated to a temperature of perhaps 1800° C. in an electric furnace. This process has not been developed far enough to show its ultimate power requirements, but it is approximately in the same class as the cyanamide process. The aluminium nitride after formation may be decomposed with steam, or dilute caustic solutions, yielding ammonia and regenerating the alumina.

4) *The direct synthetic ammonia process*, usually called the HABER process, wherein nitrogen and hydrogen are combined in the presence of a catalyst at temperatures of from 500° to 600° C. under a pressure of 100 atmospheres or more. The ammonia made by this process is then oxidised and converted into nitric acid. Electrical energy is not necessary for this purpose and the total power requirements are only about 0.5 h. p.-year per ton of nitrogen fixed as nitric acid per annum.

5) *The Cyanide Process*, wherein a mixture of sodium carbonate and coke, with iron in small quantities, is heated in a stream of pure nitrogen to a temperature of approximately 1000°C., resulting in the formation of sodium cyanide, which may be decomposed with steam in order to yield ammonia. The power required by this process is about as much as is needed by the Haber process.

It will be seen that only the arc process forms nitric acid directly; all the others yield ammonia as their initial product. The ammonia may be oxidised to nitric oxide by air in the presence of a catalyst (usually platinum), working at 750° to 850° C. This oxidation process requires very little external energy.

The accompanying table, which has been drawn up from the diagrams of the writer, shows how the production of inorganic nitrogen compounds increased during the war in different countries during 1909, 1913 and 1917; the increase is expressed in tons of nitrogen.

World Nitrogen Production in Tons.

	1909	1913	1917
I. <i>As Chile sodium nitrate:—</i>			
United States	46 000	86 000	155 000
Germany	101 000	120 000	—
The Allies	151 000	176 000	208 000
Other Countries	—	—	9 000
Totals	298 000	382 000	372 000

II. *As ammonia, by-product of coke oven:—*

United States	21 300	40 000	76 000
United Kingdom	75 000	97 000	112 000
France	11 800	17 000	23 000
Germany	72 000	102 000	150 000
Italy	71 000	87 000	30 000
Russia			7 000
Other Countries			63 000
Totals	212 000	343 000	461 400

III. *As Calcium cyanamide:—*

United States		12 000	12 000
Germany	10 000	12 000	110 000
Italy		12 000	10 000
France and Switzerland	10 000	—	28 000
Austria		—	10 000
Sweden and Norway		—	8 000
Other Countries		10 000	8 000
Totals	20 000	55 000	186 000

IV. *As product of electric arc process:—*

Sweden and Norway	5 000	10 500	31 000
Other Countries	—	3 500	3 000
Totals	5 000	20 000	34 000

V. *As product of the Haber synthetic process:—*

Germany	—	8 000	114 000
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VI. *As product of other processes:—*

Germany	—	—	39 000
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SUMMARY:

I. As Chile sodium nitrate	298 000	382 000	372 000
II. As ammonia, by-product of coke ovens	211 000	343 000	461 000
III. Cyanamide process	20 000	55 000	186 000
IV. Electric arc process	5 000	20 000	34 000
V. Haber synthetic process		8 000	114 000
VI. Other processes			39 000
General total	535 000	808 000	1 206 000

This Table shows (1) that, leaving out of consideration the Haber synthetic process, which is exclusively employed in Germany, the two processes that have had the greatest industrial development are the electric arc and the calcium cyanamide processes.

The electric arc process, however, only furnishes about 3 % of the nitrogen necessary, in the form of inorganic compounds, for the world's industries. Experts state that, in order to obtain good economic results,

(1) The writer only claims approximate accuracy for his diagrams: Cf. Intern. Inst. of Agriculture: *Production et consommation des engrais chimiques dans le monde*, 2nd. Edit., 1914; *Mouvement international des engrais et produits chimiques utiles à l'agriculture, passim.* (Ed.).

it is necessary that the electrical power should be very cheap. Some assert that the price should not exceed 12 dollars per h. p.-year, others say it must be as low as 8 dollars. Though there are attractive theoretical possibilities for increasing the efficiency of the arc process, it is clear that really large plants can only be established in regions like Sweden and Norway, where the natural conditions of the country permit of electric power being produced at a low cost.

The calcium cyanamide process also requires large quantities of electrical energy, but only one-fourth as much as the arc process. It needs as raw materials large amounts of pure limestone and coke. It is, however, an interesting fact, that this is the process that has most developed, especially in Germany, during the war. While many metals, on being heated in nitrogen, yield nitrides from which ammonia is easily obtained, aluminium nitride has received most attention, because of the possibility of using the alumina, which remains as a by-product, for the aluminium industry. The commercial developments of the past have not been successful, and though more is hoped from the installations now being tested in America, it must still be regarded as rather an unproven process. Like the arc process it requires much electrical energy.

The cyanide process does not require electrical power and uses as its raw materials sodium carbonate, coke, iron and pure nitrogen. The iron is always recoverable, and if the cyanide is converted into ammonia under proper conditions, the sodium carbonate can also be recovered. This process has been carefully studied by the United States Government and by several American corporations during the war, because it does not require a large amount of electrical power, but its commercial possibilities have not yet been established. At present, this process involves much capital, labour, and heavy repair costs, but must not, however, be condemned in its present immature form.

The direct synthesis of ammonia from nitrogen and hydrogen has been much developed in Germany, and the name most frequently associated with it is that of HABER. The reaction between nitrogen and hydrogen is extremely simple to write, but very difficult to carry out economically. To do so involves the solution of many problems which may be divided into the following groups:—

1) preparation of pure nitrogen; 2) preparation of pure hydrogen; 3) preparation and preservation of catalyst; 4) construction of plant, which must work at a high temperature and under high pressure.

The arc process alone directly fixes the atmospheric nitrogen with the oxygen associated with it in the air; in all the other processes, it is necessary first to separate the nitrogen from all the other gases present in the air. The liquid air process most satisfactorily solves the problem of obtaining sufficient pure nitrogen in a cheap and reliable manner. A nitrogen column, as delivered to the United States plants, has an hourly capacity of 20 000 cu. ft. of dry nitrogen with less than 0.1 per cent oxygen or an expenditure of 180 h. p.-hrs.

In order to obtain synthetic ammonia, not only nitrogen, but also

hydrogen is required ; that is to say a mixture of the two gases containing 75 % hydrogen by volume is needed. Hydrogen is formed as a by-product in the electrolytic preparation of soda or caustic potash, but the expense of collecting and purifying it is considerable. Hydrogen and oxygen can also be made by the electrolysis of water, but it is difficult to find a location where both gases can be used to advantage. Hydrogen can be obtained by the action of steam upon red-hot iron, and by the water-gas reaction wherein steam reacting with coke produces approximately equal volumes of hydrogen and carbon monoxide. By further reaction with steam on the carbon monoxide in the presence of a catalyst, approximately equal quantities of carbon dioxide and pure hydrogen are produced, so that for 1 volume of easily eliminated carbon dioxide, 2 volumes of hydrogen are obtained. Although this process necessitates a long and elaborate purification of the gas, manufacturers at the present moment seem inclined to prefer it to the other methods.

As regards the future of the nitrogen fixation industry, the writer remarks that it depends upon two factors, the demand for fixed nitrogen, and its price. These two factors are in part independent, and in part linked together, for a lowered price is certain to cause a greater demand. The principal demand of the last few years has, however, been for munitions, and the demand was an insistent one, which had to be met, regardless of price. On the other hand, the great normal demand for fertilisers has been restricted to a minimum. The largest demand for fixed nitrogen in the future will probably be for fertilisers, and the use of the latter will be very largely a matter of price.

From 1909 to 1917, there was, roughly speaking, an increase of fifty per cent. in output for fixed nitrogen for each four-year period, but it is not probable that 1921 will show such a proportionate increase, although if all the resources of Chile, and all the facilities in the way of coke ovens now under construction, and all the fixation plants should be utilised, the year 1920 might well see a possible production of 25 per cent. more than in 1917, when the war was at its height.

What will be the cost of production? The cheapest source of fixed inorganic nitrogen will undoubtedly be the ammonia from by-product coke ovens, and the cost of collecting it and putting it into marketable form is small. The coke ovens of the world can now produce more fixed nitrogen than the world used from all sources ten years ago. It is probable that Chilean nitrate could if necessary, be sold at lower prices than in former years.

The fixation processes will therefore have to be prepared to meet possible low prices. The cost of nitrogen in the staple raw materials, sodium nitrate and ammonium sulphate, varied in America from 2 dollars to 16 dollars per hundred pounds in the years 1900-1915. It is manifest that a process which is to produce a large proportion of the world's fixed nitrogen must be able to compete with these materials. Smaller factories may produce specialised products such as sodium nitrate and anhydrous ammo-

nia for which there is a demand, large in itself, but small in proportion to the world's total demand.

CONCLUSIONS. — In competing with Chilean nitrate and coke oven ammonia, the cyanamide and arc processes are both handicapped by the requirement of large amounts of electrical power. The same might be said of the nitride process, but this possesses a possible advantage in the recovery of alumina as a by-product. The cyanide process labours under the disadvantage of small manufacturing units, but it needs little electric power, while its by-products such as formates, are useful.

The direct synthetic ammonia process presents great engineering and chemical difficulties, but has much possibility of future development. If an inventor could find a catalyst active at 300°C. and allowing of the pressure necessary to the reaction to be reduced to 30 atmospheres, it would be possible to eliminate many of the difficulties which at present hinder the development of the process. There is no theoretical reason why such a catalyst should not be made, and its discovery would offer the possibility of cheaper fixed nitrogen than any heretofore known.

835 — **Transformation of Explosives into Fertilisers.** — LISSONE, S. in *Le Industrie Chimiche*, Year I, No. 1, pp. 29-30 Milan, 20 July, 1919.

Unused explosives which fill military magazines may constitute very rich nitrogenous fertilisers as they contain much ammonium nitrate, but it would be dangerous to make them over as they stand to cultivators. For this reason the Italian Government has employed Prof. F. GARELLI, Director of the Laboratory of Industrial Chemistry of the "R. Politecnico" of Turin in studying how to transform explosives into fertilisers. For separating the nitrate of ammonia from the mixture Prof. GARELLI takes advantage of the great solubility of this nitrate in water. By adding a fixed quantity of water to the explosive mixture in special vessels and letting the thick liquid settle, he obtained a dense solution of nitrate of ammonia which he decanted. To this solution he added and mixed powdered peat and after rapid drying he obtained a fertiliser which he calls "nitrated peat" and which has the following percentage composition. — Water 17.8; Ash 18.8; Nitrate of Ammonia 42.8; Organic matter 20.6. This fertiliser is a blackish powder and contains 16.4 % of nitrogen (7.5 % of nitric nitrogen; 7.5 % of ammoniacal nitrogen; 1.4 % of organic nitrogen) plus 0.6 % of phosphoric anhydride and 1.8 % of potash. Its composition is therefore similar to that of nitrate of soda and can be used instead of the latter in manuring cultivated land.

Experiments required for ascertaining the fertilising value of "nitrated peat" have been entrusted to Prof. CHIRJ GAMACCHIO, Director of the provincial professorship of Agriculture at Turin, but the results of some experiments made in the Alba district already warrant the assertion that the new fertiliser has an effect about equal to that of nitrate of soda.

- 836 - **The Manganese of Basic Slag and its Effects on the Growth of Wheat.** — Mac HARGUE, J. S. (Kentucky Agricultural Experiment Station) in *The Journal of Industrial and Engineering Chemistry*, Vol. XI, No. 4, pp. 332-345, 4 figs. Easton, Pa., April 1 1919.

The objects of the experiments described in this paper were to study the effect of manganese on the growth of wheat under different conditions, and to find out a new source of this element for agricultural use.

In the case of water cultures, a certain amount of manganese was found to stimulate the growth of wheat and increase the nitrogen content of the grain. With pot cultures, the best results were obtained by adding 5 gm. of carbonate of manganese per 8.500 kg. of soil, that is to say, by using 0.028 per cent. of manganese.

The writer examined some samples of basic slag which he found to contain an average of 5 per cent. of manganese, hence he suggests that it is possible that some of the benefit to crops resulting from the use of this fertiliser on certain soils, may be due to this element.

AGRICULTURAL
BOTANY,
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

- 837 - **Systematic, Morphologic, and Anatomic Study of the *Chlaenaceae* in Madagascar.** — GÉRARD, HYLIX, in *Annales du Muséum colonial de Marseille*, Year XXVII, 31d Half-year, Vol. VII, Part I, pp. 1135, bibliography of 34 publications Paris-Marseille, 1919,

The author revises the still little known family of the Chlaenaceae, a family essentially of Madagascar, and of which the plants are chiefly ornamental (very little is known of their uses).

This family, in which 27 species were recorded before the present publication, now numbers 38 species, the author having described 11 new ones.

The author has finally adopted 7 genera which are : — *Sairochlaena* (5 species), *Xerochlamys* (11), *Leptochlaena* (7), *Schizochlaena* (6), *Rhodochlaena* (5), *Xylochlaena* (2), *Eremochlaena* (2).

- 838 - **The Chemical Constituents of Natural Rice and Polished Rice.** — See No 870 of this Review

- 839 - **The Composition of the Fruit of *Vitis hederacea* (Virginia Creeper); the Oils of these Fruits.** — See No 994 of this Review.

- 840 - **Extraction of Arbutin and Quebrachite from the Leaves of *Hakea laurina*.** — BOURQUELOT, E. and HÉRISSEY, H., in *Comptes Rendus de l'Académie des Sciences*, Vol. 168, No. 8, pp. 414-417. Paris, February 24, 1910.

Hakea laurina R. Br. (synon. *H. eucalyptoides* Meissn) is a tree of the family Proteaceae, native of Australia and cultivated in France on the Mediterranean coast. The authors have applied to the study of the leaves of this tree the biochemical method used for plants rich in tannin, that is to say extraction with boiling alcohol; distillation of the alcohol, precipitation, almost complete, with sub-acetate of lead, concentration of the extract under reduced pressure, recovery of the extract with thymol water; estimation of reducing sugar in this solution; rotation found and successive addition of invertin and emulsin. The ex-

mination of the figures obtained shows that the leaves of *Hakea* contain (1) Saccharose as is usual in all phanerogams; (2) Two hydrolysable glucosides, of which one is arbutin; (3) a lævo-rotary, non-hydrolysable element, quebrachite.

The authors describe in detail the method of extraction of arbutin and quebrachite and finally remark that these two elements have already been found together in the leaves of *Grevillea robusta* A. Cunn., a tree also belonging to the family Proteaceæ.

841 - Study of the Biochemical Changes Due to Environment. — ROSENHEIM, O (Physiological Laboratory, King's College, London), in *The Biochemical Journal*, Vol. XXII, No 4, pp 283-289 + Bibliography of 14 References. London, December 1918.

In his experiments, the writer found that the amount of chromogenic substance contained in the inflorescence of the edelweiss (*Leontopodium alpinum*) varies according to the altitude at which the plant grows. Thus, plants grown in London at an altitude of 80 m., contain only one fourth of the amount found in plants collected in the Alps at an average altitude of 2000 m. The chromogenic substance is probably a flavone. These facts illustrate the biochemical adaptation of alpine plants to changed environment, and speak in favour of the assumption that the biological significance of flavones in the plant consists in their protective action against the injurious influence of ultra-violet light. The growing season of alpine plants coincides with the maximum intensity of chemical sunlight in the year, and the necessity of some protective mechanism of the living protoplasm against the injurious action of ultra-violet light is apparent. The writer's experiments with other alpine plants (*Saxifraga* sp., *Dryas octopetala* and *Campanula pusilla alba*) corroborated these results. When examined in February, a month in which the amount of ultra-violet light in London is extremely low, they contained hardly any flavones, whereas later, in July, the presence of flavones was easily detected.

842 - Influence of Light on the Absorption by Plants of Organic Matter in the Soil. — CEBRIAN DE BESTEIRO and MICHEL DURAND, in *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVIII, No 9, pp 467-470 Paris, March, 1919.

Research carried out on a light-demanding plant, *Pisum sativum*, with a view to the study of the problem, "have plants living in feeble light the faculty of obtaining their carbon, which under the circumstance in which they live might be insufficiently obtained by the action of chlorophyll from carbonic acid gas in the air, by drawing from the soil a larger quantity of carbon contained in organic substances?"

The conclusions drawn from the research are: -

(1) The plants increased in dry matter by amounts proportional to the intensity of light to which they were exposed.

(2) The roots as well as the parts of the plant above ground developed proportionately to the light in which the plants grew.

(3) The different individuals drew from the nutritive medium a quantity of glucose proportional to the intensity of light in which they were cultivated.

(4) The same weight of roots absorbed considerably more glucose under feeble light than under strong light.

(5) The same weight of the entire plant absorbed from the culture medium a quantity of glucose appreciably the same under different intensities of light.

For the pea, therefore, there is neither parallelism nor compensation between the absorption of carbon by the green leaves from the carbonic acid gas in the air and the absorption of organic carbon by the roots from the soil.

843 - **Influence of Continued and Intermittent Action of Light and Heat on Growth** — JACOBI, HILFEN (Biologische Versuchsanstalt der Akademie der Wissenschaften in Wien), in *Akademie der Wissenschaften in Wien Sitzungsberichte, Abteilung I*, Vol 127, Part. 4 and 5, pp 311-316, 3 fig Vienna, 1918.

The author submitted small plants of wheat (*Triticum vulgare*) to the action of various physical agents considered as stimulating, such as continued and intermittent action of light and heat, action of monochromatic light, etc.

He has observed the following effects exercised by these different agents on the growth of the plants:—

Intermittent action of light or heat brought to bear on the young plants of wheat caused an acceleration in the growth followed by slowing down which brought it back to normal. Continuous and steady illumination by means of white light and also steady darkening had no influence on the regularity of the rate of growth.

Continuous illumination by means of monochromatic sources of light (blue, yellow, green), on the contrary caused irregular growth. The growth of plants submitted to monochromatic illumination is greater than that of etiolated plants, that is to say plants kept in continuous obscurity. Plants submitted to yellow monochromatic illumination attained the greatest height.

844 - **The Influence of Sunlight upon the Action of Stomata in Certain Gramineae.** — GRAY, F, and PRIEST, G J. (Leland Stanford Junior University, California) in *American Journal of Botany*, Vol VI, No. 4, pp 131-155 + 18 diagrams + Bibliography of 9 publications. Lancaster Pa., April, 1919

The writers give a short summary of the literature dealing with the mechanism of the stomata, and state that the study of these papers led them to make certain experiments which showed that the turgidity of the guard-cells is a necessary factor in producing and maintaining their elasticity, but that the direct agent controlling the opening and closing of the stomata is the sunlight.

The writers then give the result of their experiments with wheat (*Triticum vulgare*), cultivated oats (*Avena sativa*), rye (*Secale cereale*) barley (*Hordeum sativum*) and wild oats (*Avena fatua*). These gramineae were grown in a greenhouse under different soil and moisture conditions and with varying degrees of illumination, and were examined at various

stages of their vegetative growth. As a control, some of the same species were grown out of doors.

It was found, that these gramineae react similarly but not identically, under like conditions, for each species displays individual differences which partly explain the differences in needs and behaviour that are familiar to the practical farmer. Thus barley, wheat, and oats live under essentially similar conditions of soil and of moisture, while rye is best grown in drier and warmer localities. The following observations, however, apply equally to all the four species: 1) the stomata open in the presence of light and close in darkness; 2) increase or decrease in the amount of light, when it has reached a minimum intensity, will have a corresponding effect upon the width of the stomatal openings; 3) the opening and closing of the latter being accomplished by the changes in shape of the guard-cells of the stomata, a minimum amount of moisture in the soil is required by each species in order to produce and maintain the turgidity of the guard-cells, without which changes in their shape are impossible.

845 - **Alteration of Cellular Exchange and Permeability at Temperatures near Freezing Point.** — PANTANELLI, E. (R. Stazione di Patologia vegetale di Roma), in *Atti della R. Accademia dei Lincei, Serie Quinta, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXVIII, Part. 5-6, 1st Half-Year, pp 205-209. Rome, March 2 and 16, 1919

The author has deduced from previous experiments that the resistance of plants to cold is not in proportion to the concentration of the cell sap, nor to the acids or salts which it contains, but according to the proportion of sugar which the cell is able to retain during the cold period (1). The question was whether the sugar acted simply as a source of energy in respiratory combustion (2) or if it protected the protoplasm against eventual auto-digestion (3).

With this object it was necessary to observe the alimentary exchange of the cell at a minimum temperature. But, as it had been ascertained that in aerial organs exposed to very low temperatures there was a rapid loss of water by transpiration it was suspected that one of the chief factors causing death by cold is the great increase of the permeability of the plasma to water and liquids, all the more so since it has been shown (NÄGELI 1861; DIXON and ATKINS 1913; MAXIMOV 1914) that plasma when frozen became completely permeable. To control the changes in permeability during the cold period it was therefore necessary to use organs which could be

(1) See *R.*, Dec. 1918, No. 1340 — See also *R.*, Nov. 1918, No. 1217. (*Ed.*)

(2) Respiration acts also at low temperatures at the expense of carbohydrates so long as there are any (*Author's note*).

(3) IVANOFF (1901), PALLADIN and KOSTYRSCHEW (1906), DILCANO (1912), PANTANELLI (1914) have already shown that so long as a vegetable cell has sugar at its disposition it does not consume albumens, or rather that decomposition is compensated by synthesis; but as soon as the sugar is exhausted autodigestion of proteins is noticed. FERMI (1912) also has made numerous contributions demonstrating the preservative or antiproteolytic action of sugar. (*Author's note*).

submerged under water without loss of functional activity. The author selected the pulp (endocarp) of the tangerine orange (*Citrus nobilis*) which has the further advantages of being sufficiently large to furnish matter necessary for control, of having a homogeneous structure, of containing a minimum of dead cells, and of being prepared without suffering injury.

One half of each fruit was analysed before being placed in the refrigerator and the other half afterwards.

As it was proved that separated quarters of orange froze at about -6°C ., in some series of experiment the temperature was not allowed to go below $-5^{\circ}5\text{C}$; in one series of experiments the temperature was lowered until death resulted from freezing. The lowest temperature was maintained for at least 12 hours. Then the matter was at once examined before the temperature had time to rise.

The results show that the cells of the endocarp of a tangerine orange subjected to cold at a temperature near that of freezing present:—

(1) A progressive increase in cellular permeability indicated: (a) by a rapid emission of water from tissue kept dry; (b) by exosmose from tissue placed in water. It is helped by certain substances, which rapidly penetrate the cell (glycerin, ethyl alcohol, citric acid, free alkali).

(2) Rapid destruction of sugar, controlled by provision of substances which are capable of being absorbed and used in respiration (glycerin, ethyl alcohol, citric acid) or by substances which hinder exosmose of sugars or of the intermediate products of respiration (sodium chloride, phosphate of potash, citric acid). Sugars present in the exterior liquid (saccharose, glucose) do not act in this way because they are not absorbed.

(3) Considerable auto-digestion of proteins, all the more important when the exosmose of soluble products of digestion is helped and the destruction of the sugars is more rapid.

846 - **Relation of Physiological Characters of Autumn and Spring Cereals to the Temperature and Periodicity of Growth Phenomena.** — See No 866 of this *Review*.

847 - **Research on the Mineral Nutrition of Plants.** — MAZÉ P., in *Annales de l'Institut Pasteur*, Vol XXXIII, No 3, pp 139 173 13 Tables, 8 fig. PARIS, March 1919.

The author endeavours to determine what elements should be contained in a purely mineral solution capable of ensuring the complete growth of maize cultivated out of reach of microbes.

The complete development of maize can take place in a medium containing the 11 following elements N, P, K, S, Ca, Mg, Fe, Cl, Si, Zn, Mn, and in addition Na (the utility of which has still to be demonstrated) when this medium is prepared without being particularly careful of the purity of the water and the components which form part of it. But if some care is taken in selecting the commercial products used, and if distilled water of reasonable purity is used, it is found that the plant cannot complete its cycle of growth in such a purified solution; to the 11 elements in the ordinary solution it is, in that case, necessary to add one or more elements which have to be ascertained and it is probable that these will

be found among those whose utility has already been admitted, that is to say aluminium (Al), boron (B), fluorine (F), iodine (I), and arsenic (As). A delicate question presents itself when the problem is attacked experimentally; in what degree of concentration should the plant be offered these complementary elements? In fact, the results given by a preliminary series of experiments, in which these complementary elements were given in the form of sulphate of aluminium, borate of sodium, fluoride of sodium and iodide of potassium at a strength of $\frac{1}{50\,000}$, showed the author that these 4 elements had been offered in too great strength. In a second series of experiments in which the elements in question were given in the same form at a strength of $\frac{1}{100\,000}$ the author came to the same conclusion.

In a third series of experiments he used the following strengths: — sodium arseniate $\frac{1}{500\,000}$; sodium fluoride $\frac{1}{500\,000}$; aluminium sulphate $\frac{1}{100\,000}$; sodium borate $\frac{1}{250\,000}$; potassium iodide $\frac{1}{250\,000}$. Suppressing one of the elements in the solution containing the 11 indispensable elements plus sodium and the 5 complementary elements, 5 other different mediums were prepared corresponding to the same number of sets of plants; finally a last set was given a nutritive solution using spring water and ordinary commercial products except in the case of the complementary elements. This third series of experiments included therefore 7 sets of plants cultivated respectively in the following mediums: —

Lot I: — Solution containing the 11 indispensable elements (plus sodium) and the 5 complementary elements.

Lot II: — The same solution leaving out fluorine.

Lot III: — The same solution leaving out arsenic.

Lot IV: — The same solution leaving out boron.

Lot V: — The same solution leaving out aluminium.

Lot VI: — The same solution leaving out iodine.

Lot VII (Control): — Solution with spring water containing only the 11 indispensable elements.

The determination of the dry weight of the plants, of the water evaporated by each plant, and of the water evaporated to produce 1 kg of dry vegetable matter, has led to the conclusion that boron, aluminium, fluorine, and iodine are indispensable for the growth of maize in the same measure as N, P, K, Ca, Mg, S, Fe, Cl, Si, Mn, Zn which gives a total of 15 elements (leaving out Na the utility of which has still to be proved); the number of elements of which maize is composed is therefore 18, counting C, H and O, the most abundant of all.

As for arsenic, it is shown to be harmful.

The author hastens to add that the composition of this "complete solution" cannot be generalised from the point of view of vegetable physiology; it is probable only that the requirements of cultivated gramineae in mineral elements are much the same as those of maize, but it is certain that the cruciferae (cabbage) and leguminosae (peas, beans, vetch, lupins) do not grow well in a solution which is suitable for maize; each family,

each genus of plants has its own particular requirements which have a bearing on the nature of the elements or on their degree of concentration in the nutritive medium. There are however some elements common to all the solutions which suit various plants, such are : — N, P, K, S, Ca, Mg, Fe, and possibly Cl and F: but it is not possible to affirm that the same is true for rare elements when it is noted that Mn and Zn play more or less the part of antidotes against poisons of alimentary origin. In this sense the elements of the solution can be classified in 2 categories ; the first contains elements of organisation, the second rare elements whose functions, still little known, consist in preventing poisoning due probably to the accumulation of transition compounds during the changes which alimentary substances undergo.

These observations only relate to the alimentary poisoning in maize due to privation of zinc or manganese : there is nothing to prove that, under the influence of the same causes, plants of other kinds react in the same way ; in other terms there is nothing which warrants the deduction from these results that rare elements indispensable to one species are also indispensable to another. It is even explicable that a definite chemical function can be ensured in the plant by two near chemical elements, which is to admit physiological isomorphism, but limited to rare elements.

Finally, in the course of his research the author has noted that development is more regular with plants cultivated in solutions prepared with ordinary salts than in those prepared with pure chemicals ; a greater tendency to accidents of iodism is also observed in maize cultivated in solutions which are chemically pure. It seems therefore that pure solutions have certain defects which cannot however be attributed to the absence of one or more of the elements which are indispensable to maize since the plants of best growth reach as great weight as the control plants : in fact the author was able to eliminate these defects by placing small amounts of organic salts, (citrate of sodium and lactate of calcium mixed in equal weights ; humus taken from a compost) in the nutritive solution. The results obtained in consequence of these very small additional amounts of organic matter indicate the beneficial influence of organic matter added to the mineral solution, but it has been shown at the same time that organic matter is not indispensable, if seminal reserves, which are not negligible in weight as they amount to about 4 or 5 decigrammes in each grain, are excepted.

If it is desired to assure good vegetative progress, it is a good thing to replace the ferrous sulphate in the nutrient solution by ferric sulphate so that the solution may not be too weak in free oxygen.

848 - The Influence of Chlorides on the Growth of Certain Agricultural Plants. —

- I. TOTTINGHAM, W. E., A Preliminary Study of the Influence of Chlorides on the Growth of Certain Agricultural Plants, in *Journal of the American Society of Agronomy*, Vol. XI, No. 1, pp. 1-32, 8 Tables, Bibliography of 81 publications. Lancaster, Pa., January 15, 1919. — II. HENDRY, G. W., Relative Effect of Sodium Chloride on the Development of Certain Legumes. *Ibid.* Vol. X, No. 6, pp. 246-249. September 1918.

I. *A preliminary study of the influence of chlorides on the growth of certain agricultural plants.* — A survey of the scientific literature dealing

with the physiological part played in the plant organism by chlorine shows that the various investigators hold very different opinions. While some consider chlorine to be indispensable to the plants' nutrition, others regard it as useful, but not essential. Further, previous field and greenhouse experiments have proved that the effects of chlorides upon plants are extremely variable, and depend to a large extent upon the species, the type of soil, and the complex of factors considered as climate. The chlorides of the different alkaline metals are not equally efficacious, but according to PLATE, may be classed in the following descending order: — Chlorides of sodium, potassium, rubidium, lithium and caesium. The writer has studied the effect of the chlorides of sodium and potassium upon different plants growing in Knop's solution in the greenhouse and, in certain cases, in the field.

The introduction of potassium and sodium chlorides into water cultures but slightly affected wheat plants (*Triticum sativum*) during the first five weeks after germination. Buckwheat (*Polygonum Fagopyrum*), on the other hand, was decidedly affected by the addition of these chlorides. Although the seed production remained apparently undisturbed, the length of roots, and the yield of dry matter were reduced. The radish (*Raphanus sativus*) in soil cultures in the greenhouse responded only slightly to the application of potassium and sodium chlorides together with a complete fertiliser. Under the same conditions, these chlorides had a favourable effect upon the carrot (*Daucus Carota*) increasing the yield of dry matter and the percentage of sugars; the reverse, however, was found to occur in the case of the parsnip (*Pastinaca sativa*).

The sugar-beet (*Beta vulgaris*) gave the same general responses to chlorides as did the carrot when grown in the greenhouse. The chlorides greatly increased the yield in dry matter and the glucose content of the roots. Similar results were obtained from the application of common salt alone to beets grown in the field.

The potato (*Solanum tuberosum*) produced increased yields of dry matter in the tuber, when potassium chloride was applied in place of potassium sulphate. As regards the percentage of starch, different varieties of potato responded differently; in some it was decreased, while in others it remained unaffected. The results indicated that the variety of plant was more important than the type of soil in determining this effect of the chlorides. In field crops, sometimes the chlorides produced a decrease in the dry matter of the tubers without altering their quality (Triumph variety), while at others, no noticeable change was effected (Rural New Yorker). Sodium chloride applied alone altered the composition of the tubers but slightly, though it affected their quality seriously.

Proceeding from the observed effects of chlorides upon diastase and other enzymes which act upon carbohydrates, the writer advances the tentative hypothesis, that the varied physiological responses of different kinds and varieties of plants to chlorides may be due to the regulation of enzyme activity by these salts.

On the whole, it appears quite possible, that further investigation may

lead to the development of practical rules for the use of chlorides in agriculture, due account being taken of those crops injured by these compounds, and of climatic and soil conditions.

II. *Relative effect of sodium chloride on the development of certain legumes.*—The visible effects exercised upon the plants by sodium chloride were as follows: 1) retarded germination; 2) retarded growth in height; 3) reduction in number of leaves; 4) reduction in dimension of leaves; 5) delay in flowering; 6) reduction in number of root nodules; 7) reduction in size of nodules; 8) premature death.

Of all the varieties used in these experiments the Lima bean (*Phaseolus lunatus*) and the white tepary (*P. acutifolius* var. *latifolius* Freeman), were the most affected by the application of sodium chloride. The bean (*Vicia Faba*), the black eye cowpea (*Vigna sinensis*), and the chickpea (*Cicer arietinum*), were less affected by sodium chloride than any of the other plants, which included in addition to those already mentioned, the following different varieties of beans: — "cranberry", "small white", "red kidney", "Lady Washington", "pink", "red Mexican", "bayo", "blue pod".

849 — **Influence of Fluorides on Vegetation.** GAUTIER, A., and CLAUSMANN, P., in *Comptes Rendus de l'Académie des Sciences*, Vol. 168, No. 20, pp. 976 982. Paris, May 19, 1919.

The authors have previously established the fact that fluorine is always found together with phosphorus in living cells, that it is found in the tissues of all animals and plants and that it becomes localised in some of them; this generalisation and this effective localisation have led the author to the conclusion that fluorine is necessary in the economy of life. As plants must necessarily take this element from the fluorides and fluophosphates of the soil in which they grow, the authors have studied the conditions favourable to this assimilation by the plant and what happens to different crops when enriched by, or deprived of, fluorides. With this object the authors have carried out a series of experimental cultures in large garden pots, comparing crops in soil as free as possible from fluorine with crops in the same soil to which fluorine was artificially added; after having tested several soils they finally adopted purified birch wood charcoal (after washing with acids and boiling water it contains only 1.87 mgm. of fluorine per kg.; it is the only known medium almost free from fluorine). This charcoal medium to which manure and arable soil were added has the following composition:—Washed charcoal, 1000 gm. (fluorine equal to 0.00187 gm.); Al_2O_3 added in the form of gelatinous alumina, 120 gm. (Fl = 0); chalk, 730 gm. (Fl = 0.002 gm.); humus 27.3 gm.; very fertile arable soil, 66 gm. (Fl = 0.007 gm.); $CaHPO_4$, 24 gm.; KNO_3 , 34 gm.; $(NH_4)_2SO_4$, 30 gm. $NaCl$, 3 gm.; $MgCO_3$, 68 gm.; $MnCl_2$, 0.80 gm.; $ZnCO_3$ 0.07 gm.; SiO_2 (gelatinous), 17 gm.; $FeSO_4$, 180 gm.; Arseniate of soda 1.4 gm. This complete mixture, fairly permeable to water, composed of indispensable mineral and biological fertilising elements, contained therefore only 11 mgm. of fluorine per kg. or 3.97 mgm. per pot.

Each kind of plant was cultivated in 3 pots; the first contained the charcoal medium of which the composition has just been given; the second contained the same soil artificially fluorated, that is to say 300 mgm. of fluorine (77 times as much as in the first pot) were added in the form of fluoride of potassium; the third pot contained ordinary garden soil to complete the comparison.

Thirteen species belonging to widely differing families (Cruciferae, Caryophyllaceae, Papaveraceae, Leguminosae, Gramineae, Chenopodiaceae, Convolvulaceae, Boraginac, Liliaceae, Compositae, Canabiaceae), were placed under experiment. The authors record for each plant, and respectively for each pot, the mean height of the plant, the state of vegetative development, the weight of seed, dry weight, etc.

The data show that out of the 13 species grown, 7 benefited by fluorine (cress, cabbage, *Escholtzia*, spinach, viper's bugloss, spurrey, hemp); 3 were unaffected (convolvulus, onion, rye); and 3 gave crops inferior to those of the control plants, (sweetpea, chickpea, centaury).

Experiments in open fields and with other fluorides are now in progress.

850 - Effect of Certain Compounds of Barium and Strontium on the Growth of Plants.

— MCHARGUE, J. S (Chemist, Kentucky Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XVI, No. 7, pp. 183-194 + 1 Plate Washington, February 17 1919

Although it has been known for more than a century that plants are able to extract appreciable amounts of the relatively insoluble compounds of barium contained in soil, very little scientific investigation has been made to determine whether or not the compounds of this element have any special function in plant economy. Because the compounds of barium are poisonous when taken into the animal body, there appears to be a general impression that they would exert a similar influence upon plants.

The writer has already shown, from the results of a former investigation, that small amounts of barium can be readily detected and determined quantitatively in the ash of tobacco, maize, potatoes, and a number of other plants grown under normal conditions in the field (1). The object of the present experiments was to determine (by growing plants in nutrient solutions) the effect of some of the well-known compounds of barium, and of the closely related metal strontium, upon the development of plants. Barium and strontium carbonates, in the absence of calcium carbonate, are poisonous to plants, the former being the more toxic. On the other hand, in the presence of an excess of calcium carbonate, both apparently exerted a distinct stimulating influence on the growth of the plants studied. (cowpeas, oats, winter and spring wheat, soy bean and maize).

Barium and strontium carbonates, when added to the sand in which the plants were growing, accelerated the growth of the roots. Neither barium nor strontium compounds can be looked upon as important plant foods. The sulphate of barium is much more poisonous than the carbon-

(1) See R. 1913, No. 924. (Ed.)

ate. On adding to the sand a small quantity of strontium nitrate, there was a corresponding increase in the nitrogen content of the wheat.

No barium compounds were found in the residue obtained upon evaporating 25 litres of drainage water collected from the drain-tiles on the Kentucky Station farm, which would indicate that the barium found in plants is taken up on the spot by the roots of the plants.

851 - **Physiological Effects of Copper on the Growth of the Vine.** — See No. 913 of this Review.

852 - **The Influence of Phosphates on the Action of Alpha-Crotonic Acid on Plants.** — SKINNER, J. J. and REID, F. R. (Bureau of Plant Industry, Washington), in *American Journal of Botany*, Vol. VI, No. 4 pp. 167-180, 6 tables, 8 figs. Lancaster, Pa., April, 1919

The writers have studied the effect exercised by alpha-crotonic acid upon young wheat plants grown in nutrient culture solutions composed of calcium acid phosphate, sodium nitrate, and potassium sulphate. They found that alpha-crotonic acid in amounts of 25 to 30 parts per million had a very injurious effect upon the growth of these plants; that growth was reduced about 50 per cent. when the crotonic acid was used in amounts of 50 parts per million, and 35 per cent. when the concentration was 25 parts per million.

Further, phosphates were observed to decrease the harmfulness of alpha-crotonic acid. Where large amounts of P_2O_5 were present in the nutrient solution, the effects of the above-mentioned acid were very much milder than in those solutions containing a small amount of P_2O_5 . The substitution of $Na_2 H_2PO_4$, $Na_2 HPO_4$ and Na_3PO_4 for phosphate of calcium showed that each of these phosphate salts, regardless of their basic or acid character, had an antagonistic action towards alpha-crotonic acid, and seemed to prove that this action is due to the phosphate radical.

853 - **On a Species of Bacteria Found in the Roots of Rocket (*Diplotaxis erucoides*)** — PEROTTI, R., in *Atti della R. Accademia dei Lincei, Serie Quinta, Rendiconti, Classe Scienze fisiche, matematiche e naturali*, Vol. XXVIII, Pt. 9-10, 1st Half Year, pp. 331-335. Rome, May 4 and 18, 1919

The farmers of the Roman Campagna generally agree that the crucifer *Diplotaxis erucoides* D. C. (commonly called "rughetta") fertilises the soil, for which reason it is used as green manure in gardens and orchards, where it grows in abundance.

The author has sought out what foundation there is for this opinion and he has ascertained that a species of bacteria is found constantly in the cortical layer of the roots of *D. erucoides*; he describes it as follows: —

Rods short, measuring $1.5 - 1.6 \times 0.6 - 0.8 \mu$, more rounded at one end and frequently united, very mobile but very quickly losing power of movements, peritrichous. These bacteria stain well with aniline dyes and they resist decoloration by Gram. They energetically liquefy gelatin. They are facultative anaerobes and do not form spores. This bacterium is neither ammonifying, nitrifying nor de-nitrifying nor does it fix nitrogen, at least under the artificial conditions of development under which it was placed. It is, however, certain that it has energetic preteolytic properties

which would account for its normal presence in the roots of *Diplotaxis* where it induces or helps the movement of albuminoids in the plant; it is also probable that it can attack insoluble carbohydrates. There is, therefore, reason to believe that symbiotic relations exist between the bacillus and the plant.

PLANT
BREEDING

854 - **Pure Line Selection of Cereals in the Province of Bologna and in the Roman Campagna, Italy.** — TODARO, G., in *L'Italia agricola*, Year LVI, No. 5, pp. 129-146, 14 fig. Piacenza, May 1919.

The more important results of the work of selection carried out by the author in the above-mentioned regions are briefly as follows: —

WHEAT. — *Lines or kinds of the type "Rieti"* — There are 3 kinds designated by the following genealogical formulae: —

$$1 \left(28 - \frac{08}{09} \right) \quad 2 \left(29 - \frac{08}{09} \right) \quad 3 \left(129 - \frac{08}{10} \right)$$

The first number outside the parentheses represents the number of annual order of the lines in the genealogical book: the first number inside them indicates the plot where the first selection crop was grown; the fractional numbers indicate the year of this first crop (numerator) and the year of creation of the line or kind (denominator).

These lines or kinds have been isolated, by genealogical selection, from cultures of common "Rieti" wheat. The lines No. 1 and No. 2 are both characterised by light coloured ears, similar in form to those of one of the types most largely met with in impure "Rieti" wheat. They seldom escape rust, but this is seldom severe enough to diminish sensibly the heavy production of grain which they can yield on land which does not contain excess of assimilable nitrogen.

Variety No. 1 has given excellent results not only in the Province of Bologna, but also in the Roman Campagna where, according to the author, it could advantageously replace "Rieti" wheat of impure origin.

In view of greater use in future these two kinds should be tested culturally chiefly on good land in the low and middle hills after weeded crops or fodder crops have removed from the soil the superabundance of nitrogenous matter.

Variety No. 11 has also light-coloured ears but these are noticeably longer and bear frequently some supernumerary spikelets. Its vegetative cycle is a little longer than those of the two other kinds, but it is much less subject to attack by rust, so much so that it can even be advantageously cultivated on level ground (that is to say in conditions favourable to the development of *Puccinia*), if the same conditions of soil and rotation required by varieties No. 1 and 2 obtain.

Lines or kinds of the "Cologna" type. — There are also three of these kinds designated by the following genealogic formulae: —

$$12 \left(605 - \frac{08}{10} \right) \quad 29 \left(362 - \frac{09}{11} \right) \quad 31 \left(405 - \frac{09}{11} \right)$$

They have been isolated by genealogical selection from ordinary crops of "Cologna" wheat.

Variety No. 12 is the earliest and most resistant to rust; these two valuable characters, apparent in the first selection crop, have been confirmed several times in all the suitable places (Province of Bologna, etc) where this variety is grown.

Regarding the productivity of this kind, the two control crops (following the first of 1908-1909), experimental breeding, and still more tests made on a large scale in ordinary cultivation (where this kind covers several thousand hectares) have always given excellent results. For example, on level ground and on the low hills in the Bologna district, this kind produces generally 24 to 25 quintals of grain per hectare and often more than 30 quintals, even in the Roman Campagna and elsewhere.

The two kinds No. 29 and No. 31, very much alike, differ from kind No. 12 in their somewhat longer vegetative cycle and by being slightly less resistant to rust. But under the same cultural conditions they clearly excel kind No. 12 in vegetative vigour and if they escape rust and early lodging they produce even considerably more grain and straw than it does.

Kind No. 31, introduced 6 years ago in the Roman Campagna, is already extensively used is ordinary cultivation.

Lines or kinds of the "Gentil Rosso" type. There are 2 of these distinguished by the following genealogical formulae:—

$$48 \left(560 - \frac{90}{11} \right) \quad 58 \left(643 - \frac{09}{11} \right)$$

The heads of the line came respectively from Ravenna and Vedrana.

Kind No. 48, semi-bearded (awns slightly developed in the spikelets of the upper third or half of the ear), is a little earlier than kind No 58, beardless and has a tendency to spread rapidly.

While preserving kind No. 58 with a view to study, the author proposes to replace it partly by kind $91 \left(112 - \frac{14}{11} \right)$ of the type "Carosello delle Marche" which is very like it but is considerably more vigorous and productive.

Compared with kinds of types "Rieti" and "Cologna", those of the group "Gentil Rosso" and "Carosello" have stronger culms which makes them more resistant to lodging. It is true that they do not escape rust, but they should not be considered as among wheats very subject to that disease. They generally do well even in the very fertile soil of the plain of Bologna, and are really successful on good soil in the lower hills (150-400 m.) where they more readily escape rust.

Line or kind of type "Hâtif inversable de Vilmorin". — The line designated by No. 38 and the genealogic formula $38 \left(677 - \frac{10}{11} \right)$ comes from an ear gathered in 1910 at Budrio (Province of Bologna) in a field of "early non-lodging Vilmorin" wheat.

It is known that this hybrid represented by DE VILMORIN as "early" in comparison with French wheats, especially those of the Department du Nord, turns out to be, in Italy, later than all other soft wheats generally cultivated, even in the northern and central provinces. This is its weak point, for if the month of June is too dry and too hot, scorching may hasten ripening and diminish both the quantity and quality of the crop. Now line No. 38 (beardless) proves a little earlier than the others and rather less subject to rust. In the richest soils it can compete with all wheats so far known in Italy and elsewhere since it has indeed shorter and stronger culms than those of all other wheats.

Line No. 96 is characterised by semi-bearded ears and it ripens some days earlier than kind No. 8, which perhaps will cause it to be preferred to the latter; cultural tests will decide this point.

OATS. — Among the numerous kinds selected in the Province of Bologna and in the Roman Campagna $6 \left(89 - \frac{14}{15} \right)$ and $9 \left(146 - \frac{14}{15} \right)$ rank first.

Variety No. 6 with a longer vegetative cycle is intended for autumn sowing; variety No. 9, much earlier, is for spring sowing which in the Province of Bologna is much more important than autumn sowing. Unfortunately the small extent under oats in the district of Bologna and Emilia and the too recent creation of these two kinds have not yet enabled them to obtain the diffusion which they merit, diffusion obtained, on the contrary, by similar kinds which the author has introduced in the Roman Campagna, where the cultivation of oats is much more extensive. Nevertheless the yield in grain of 30 to 35 quintals per hectare which the autumn kind No. 6 gave in 1917-1918 at San Pietro in Casale, at Portonovo di Medicina, etc. may be mentioned.

MALTING BARLEY. — Selection cropping only commenced in 1917-1918 in the Province of Bologna and in the Roman Campagna with material taken from small adaptation crops of the Swedish barleys Chevalier, Hanna, Primus, and Svalöfs Prinzess.

In 1918, these barleys were cultivated in parallel after autumn and spring sowing: as the autumn sowings produced more and much better grain, the present crops (experimental breeding) are all started with autumn sowing.

Of the 4 kinds noted above, those which appear the most adaptable are Primus and Svalöfs Prinzess which are respectively the earliest and the latest of the four. The author proposes, in 1920, to subject them to field tests in the middle and upper zones of the hills of Bologna where there is the best chance of getting satisfactory grain from the point of view of its yield of maltose.

855 - Selection of Cereals in Värmland, Central Sweden. — NILSSON, G., in *Svensk Utvårdnings Tidning*, Year XXIX, Part. 1, pp. 20-22 Malmö, 1919.

At the beginning of 1918, the Värmland Station for the selection of cultivated plants commenced its own work in close collaboration with the

central station of Svalöf. Its experimental fields are in the Varpnäs estate not far from the town of Karlstad.

The agrogeologic conditions at Värmland are generally good as is indicated by the high percentage of cultivable land which places this province in the fifth rank of all in Sweden.

On the other hand, the greatest obstacle to the development of cultivation is the very unfavourable climate. The late, cold spring always delays the sowing time of cereals, and the plants are later exposed at the most critical phase of their growth to drought which prevails at the end of spring and the beginning of summer.

These climatic conditions indicate to the selector the path to follow. Thus for oats, which are largely cultivated in the southern part of Värmland, a white grained variety both productive and better able to stand drought is required. Good results in this way can be obtained by suitable crossing of white and black oats; hybrids of this kind produced at Svalöf are already under trial. In the northern part of Värmland varieties which ripen early, as the indigenous oats, and which are at the same time productive, like the Guldregn variety kind, are required. In Värmland rye occupies 12 % of the cultivated area. The variety "Svalöfs förädlade Wasarag" (selected Svalöf Wasa rye) appears to adapt itself very well to the particular conditions of that province.

In 1914, wheat occupied only 0.6 % of the cultivated area, but sowings tend to increase with progress in cultural methods and the creation of types more and more resistant to cold and rust. In order that it may adapt itself to Värmland conditions wheat should have the resistance to cold and earliness of the indigenous wheat and at the same time stronger straw, resistance to rust and increased yield. It is sought to obtain these results in the following manner: — (1) Genealogical selection of local kinds. — (2) crossing these kinds with selected resistant kinds of the "Thule" series.

856 - **Variation and Correlation of Characters in Wheat (1); Investigations in the United States of America.** — ARNY, A. C. and GARBER, R. I. ; in *Journal of Agricultural Research*, Vol. XIV, No. 9, pp. 359-392, 21 tab., 8 fig., bibliography of 17 publications. Washington, August 26, 1918.

During the 4 years 1914-1917 the author has studied biometrically the variation and correlation of characters in wheat and has drawn the following conclusions: —

(1) The magnitude of the means is generally much influenced by environment. Lower yields of straw per plant resulted from a reduction in number, total length or average length of culms. Lower yields of grain per plant resulted from a reduction in the number of grains.

(2) Generally (but there were numerous exceptions), a reduction in the magnitude of the means is accompanied by less variability.

(3) Correlation between weight of seed sown and resultant plant cha-

(1) For similar investigations on oats, see *R.* Jan 1917, No. 26. (Fd)

racters is not high and may be diminished up to extinction by environment.

(4) Correlation between different plant characters can also be modified by environment in degrees varying with the characters considered.

(5) Increased yield of grain per plant is very closely correlated to the increase in the number of grains, number of culms, and total length of ears; it is slightly less closely correlated to the increase in average weight of the grains per plant, average height of culms, and the average length of ears.

(6) A larger number of culms per plant is accompanied by a greater total length of ears, but not by a greater average length of ears.

(7) Average weight of grain per plant, much influenced by environment, is closely and fairly constantly correlated with yield of grain and less closely correlated with the average length of ears. On the other hand the correlation is weaker, but constant, with the number of grains per plant. Average weight of grain is practically independent of average length of ears.

(8) There is a tendency for greater average height of culms to be accompanied by greater average length of ears, number of grains, and yield per plant. On the contrary the correlation between average height of culms and number of culms per plant is always low.

(9) The correlation between average length of ears and average weight of grain per plant was low in 3 out of the 4 years of the experiments.

It is important to notice the disturbing effect of external factors (soil and climate): not only did it cause the coefficients of variability to fluctuate within wide limits but it also modified the coefficients of correlation to such an extent as sometimes to change the sign.

Thus, in 1914 and 1915 the average height of plants was greater than in 1916 and 1917 owing to better soil and more favourable climate (especially in 1915).

The following Table which indicates the correlations between the average weight of seed sown and 3 characters of the resultant plants, shows the influence of climate each year on the coefficients of correlation: in 1915, a favourable year, the coefficients were lower than in 1914 when the season was good up to July, when the plants suffered from drought followed by an attack of rust; further, during the two years 1916-1917, which were unfavourable, the coefficients were noticeably higher than during the preceding period 1914-1915 when the atmospheric conditions were more favourable. The coefficients of correlation were as follows:—

Characters studied in correlation seed sown	Coefficients of correlation			
	1914	1915	1916	1917
Number of grains per plant	0.246	0.076	0.458	0.465
Total length of culms per plant . . .	0.251	0.066	0.460	0.395
Yield of grain per plant	0.143	0.088	0.445	0.478

Correlation between different characters of the plant.

As an example the following table gives the coefficients for the correlations between the yield of grain and other characters of the plant: —

Characters studied in correlation with the yield of grain per plant	Coefficients of correlation			
	1914	1915	1916	1917
Number of grains per plant	0.851	0.881	0.952	0.973
Average weight of grains per plant	0.550	0.504	0.370	0.306
Number of culms per plant	0.500	0.669	0.818	0.824
Average height of culms per plant	0.384	0.303	0.478	0.452
Total length of ears per plant	0.636	0.808	0.910	0.911
Average length of ears per plant	0.357	0.344	0.459	0.591

These coefficients support the conclusion (5) above.

There was fairly high correlation in 1914, 1916, 1917 between the average height of culms and the average weight of grain per plant, the coefficients being 0.458, 0.548, 0.426, but very low in 1915, a year of extremely favourable weather, when the coefficient was not higher than 0.071.

PRACTICAL RESULTS. — The tendency to produce increased yield shown by the tallest plants and those having the greatest number of culms is a valuable index in making individual plant selections from mixed populations.

857 — **Form of Wild Wheat Appearing in the F₂ in a Cross between Two Cultivated Wheats in the United States.** — LOVE, H. H. and CRAIG, W. T., in *The Journal of Heredity*, Vol. X, No. 2, pp 51-64, 9 fig Washington, February, 1919.

— **WILD WHEAT OF PALESTINE.** — *Triticum dicoccum* 'diccoides'. Aaronsohn (= *T. vulgare diccoides* Körnicke), growing wild in the region of Mount Hermon and elsewhere in Palestine, presents all the characters attributed by specialists to the wild ancestor of cultivated wheat, that is to say: —

Culms thinner than those of cultivated wheat; leaves narrower, pale green. Rachis brittle; when mature breaking at the joints of its segments, on each of which a spikelet, with its base surrounded with stiff hairs, is firmly inserted. Glumes, stiff, strongly adherent to the grains, which makes them difficult to thresh.

EXPERIMENTAL CROSSES BETWEEN *Triticum vulgare* AND *T. durum*. — For these experiments the authors used a typical *Triticum vulgare* (variety "Early Red Chief"), beardless, with smooth brown chaff and red grain and a typical *Triticum durum* (variety "Marouani"), black bearded, with smooth yellow or yellowish-white chaff and a colourless grain.

The result of crossing Early Red Chief × Marouani was as follows: —

F₁ Generation — Plants with characters intermediate between those of the parents. Awns few (borne only on the upper third of the spike),

very short, highly coloured but not so black as those of the Marouani parent; glumes longer and stiffer than in the female parent but not so long as in the male parent; grains red and intermediate in length.

F₂ Generation — The second generation comprised 113 individuals presenting different forms of which the numbers and affinities differed according to the characters considered. Thus there were 107 plants with brown chaff to 6 white chaff plants indicating approximately a 15 : 1 ratio. Among the plants which produced grain, 77 had red and 5 had white grains, corresponding nearly enough with a 15 : 1 ratio. In regard to the presence or absence of awns, 83 awnless plants were counted against 30 fully awned, numbers which give nearly a 3 : 1 ratio. Lastly, there were 82 plants with pointed glumes and 28 not pointed agreeing with the same ratio 3 : 1. (Generally the third generation confirmed these results).

Furthermore, among the *F₂* plants were two resembling in an astonishing degree wild Palestine wheat and described as follows : —

APPEARANCE OF WILD FORMS AMONG SEGREGATED *F₂* PLANTS. — The characters of the two plants in question were : —

- (1) Ears flattened.
- (2) Rachis, brittle, breaking at the joints of its segments.
- (3) Spikelets firmly inserted on the jointed segments of the rachis and surrounded with stiff basal hairs.

- (4) Grains very long (longer than those of either of the parents).

The only apparent difference between these two plants and true wild wheat was that the spikelets were somewhat broader than those of the wild type.

These two plants were numbered 112 and 113 respectively. The following remarks relate to their successive progeny. —

F₃ Generation. — The progeny of No. 112 numbered 70 and behaved as follows : —

- (1) There were 52 brown chaff and 18 white chaff, numbers corresponding closely to the theoretical ratio 3 : 1.

- (2) There were 18 awnless against 38 semi-bearded and 14 awned plants, approximately a ratio 1 : 2 : 1.

- (3) Most of the ears were flat and very much like those of the wild type. Some plants showed a tendency to produce compact ears several of which were flattened, but not as in the true wild type.

- (4) All the plants possessed long basal hairs similar in length and quantity to those borne on the wild type.

- (5) All the grains were red and many of them were of similar shape and length to the wild type.

- (6) Most of the plants had a brittle rachis and this most important character tended to be transmitted however much other characters might vary.

Only 10 plants were obtained in *F₃* from plant No. 113, and in general their behaviour was similar to the *F₃* generation of No. 112.

F₄ Generation. — This generation (both for No. 112 and No. 113) presented characters of the wild type : —

(1) Stems thinner than those of cultivated wheat and light green leaves.

(2) Spikes with brittle rachis.

(3) Grains red with long basal hairs.

(4) In most plants grains similar in shape to the wild type.

F₂ Generation. — All plants had a brittle rachis and some were like wild Palestine wheat in all their characters.

Conclusion: — The occurrence in the *F₂* of the cross between *Triticum vulgare* × *T. durum* of a form resembling typical wild Palestine wheat can be explained either by return to ancestral type or by natural crossing between already existing forms.

858 — **Improvement of Barley by Selection and Hybridisation, in Ireland.** — HUNTER, H., in *Department of Agriculture and Technical Instruction for Ireland, Journal*, Vol. XIX, No. 2, pp. 130-150, 11 p. Dublin, 1919.

In Ireland efforts for improving barley have made considerable progress in recent years both as regards yield and quality of grain. Two methods have been followed: — (1) selection of pure lines; (2) hybridisation and selection.

Selection of pure lines. — In Ireland, barley, whether indigenous or imported, consists of mixed crops containing numerous types differing in certain morphological and physiological constant and hereditary characters. By means of selection of pure lines it is possible to segregate from these crops types which are distinguished by greater yield, by earliness, by resistance to lodging or diseases, etc. Unfortunately, selection of pure lines requires a large number of experimental plots which necessitates reduction in the size of the plots owing to the limited area available and also to the fact that in larger plots the work of selection is increased.

For these reasons square plots with sides 4 ft. in length were adopted in Ireland, but it should be recognised that their small size makes it difficult to fix the coefficient of production for it is not easy to decide whether the differences observed are really specific or whether they are simply due to conditions of environment (soil and climate).

It is fairly well known that plants growing on the edges of the plots are, by that fact, under different conditions to the plants in the middle. To reduce as much as possible this inequality, when harvesting, the outer plants were rejected so as to reduce the harvested area to 1 m. sq. For each plot were determined: —

- | | |
|------------------------|-------------------------------------|
| (1) Number of plants | (5) Weight of grain |
| (2) Number of ears | (6) Dry weight of grain |
| (3) Weight of ears | (7) Percentage of nitrogen in grain |
| (4) Dry weight of ears | to dry matter. |

Selection of pure lines has already given positive results, as, for instance the production of a new line of "Archer" barley, much more productive than the original kind.

HYBRIDISATION AND SELECTION. — Three crossings have been made: — Archer × Goldthorpe; Archer × Spratt; Goldthorpe × Spratt.

The first has not yet produced types superior to its parents, and the investigations with the third are not yet sufficiently advanced for publication. On the other hand, the second has given interesting results which may be summed up as follows :

Spratt is a variety grown extensively in the Fen districts of the east of England. It has short, stiff straw, dense ears with diverging awns, grain short, roundish, grey in colour, somewhat coarse ; the size of the grain is often irregular owing to the compactness of the ear.

Archer is characterised by its short " neck " (i. e. the part of the stem between the point where the last leaf clasps it and the base of the ear), produces an abundant yield of good quality grain which, however, ripens late ; it has also long straw and is liable to lodge.

The object of the cross was primarily to unite in one type the quality of the Archer grain and the stiff straw of Spratt.

The hybrids of the F_1 generation had narrow ears like those of the parent Archer.

F_2 included 49 plants, of which 38 were narrow-eared and 11 broad-eared, but not uniformly so.

In F_3 the progeny of the 11 broad-eared plants of the F_2 generation all had that character ; on the other hand the progeny of the 38 narrow-eared plants divided into 12 narrow-eared plants and 26 plants with both broad and narrow ears. In other words there were 12 plants pure for the character " narrow ears " and 11 plants pure for the character " broad ears ".

These results can be represented diagrammatically as follows : —

Parents	I_1	\dots	F_2	\dots	I_3
			11 broad-eared plants		11 broad-eared plants
Archer \times Spratt	1 narrow-eared plant (49 grains)		38 narrow-eared plants		26 broad and narrow eared plants 12 narrow-eared plants

None of the broad-eared forms promised to be good yielders or of good quality, but of the narrow-eared forms two, No. 30 and No. 37 were noticeable by reason of their vigorous growth, strong straw, and attractively coloured, well filled grain.

These two forms were increased in bulk in 1912 and 1913. No. 30 was then discarded on account of its small content of nitrogen.

At present increase and investigations are being carried out for 2 forms of No. 37 designated as $\frac{37}{6}$ and $\frac{37}{18}$ which are clearly superior to the variety Archer in yield and have at the same time strong, pliant straw.

859 — Relation between the Number of Chromosomes in Different Species of Oats and their Phylogeny; Investigations in Japan. — HITOSHI KIHARA, in *The Botanical Magazine*, Vol XXXIII, No. 388, pp. 94-97, 2 fig., bibliography of 5 publications Tokyo, 1910

ZADE, who had given much study to the origin of cereals published in 1914 this genealogical tree of the species of *Avena* : —

Parent form unknown	{	<i>Avena barbata</i>	<i>A. strigosa</i>
		<i>Avena fatua</i>	<i>A. sativa</i>
		<i>Avena sterilis</i>	<i>A. Byzantina</i>

The author, relying on the fact that the chromosomes transmit to the progeny the characters of the parents, has undertaken (at the Botanic Institute of the University of Sapporo, Japan) a series of cytologic researches aimed at finding out the relation between the number of chromosomes and the phylogeny of species of the genus *Avena*.

With this object he used as material the root tips and the pollen mother-cells from the following species (and varieties): — *Avena sativa* (varieties Clydesdale, Race Horse, Sapporo Fahrenhafer, Long white Tartar, and Sapporo Nackthafer); *A. fatua*, *A. fatua glabescens* (Algeria); *A. strigosa* (Algeria); *A. barbata* (Algeria); *A. sterilis* (2 varieties, one of which from Algeria is characterised by the spikelets becoming detached from the rachis when ripe, while the other, from America, has its spikelets firmly attached to the rachis); *A. byzantina* (3 varieties from Algeria) *A. algeriensis* (Algeria).

In oats, as in wheat, the chromosomes can best be counted in the root-points, but counting can also be successfully done in the parent cells of the pollen of *Avena barbata* and *A. strigosa* during the processes of diacinesis, metaphase and anaphase.

The appended table shows the number of chromosomes found by the author in the different species of oats studied.

Numbers of chromosomes in the oats studied.

Species	x (Haploid number of chromosomes in the ripe sexual cells ("gametes"))	2x (Diploid number of chromosomes in the somatic cells)	Phylogenetic character of each species
<i>A. sativa</i>	—	42	hexaploid*
<i>A. fatua</i>	—	42	"
<i>A. sterilis</i>	21 ()	42	"
<i>A. byzantina</i>	21 ()	42	"
<i>A. algeriensis</i>	21 ()	42	"
<i>A. barbata</i>	14	28	tetraploid*
<i>A. strigosa</i>	1	14	diploid

(*) In species phylogenetically hexaploid and tetraploid, the numbers of chromosomes in the somatic cells are respectively 6 times and 4 times as large as the haploid number of chromosomes in the gametes of the species where there are fewest, that is to say, in this case, *Avena strigosa* which has 7 and is phylogenetically diploid.

TRABUT allows that the wild forms *A. fatua*, *A. sterilis* and *A. barbata*, cultivated and improved in different regions and climates, might all three have produced *Avena sativa*, the second particularly in the Mediterranean regions. According to the number of chromosomes, *A. fatua* and *A. steri-*

is would have equal rights to be considered as the ancestor of *A. sativa*, but there is no doubt that *A. fatua* has produced the greater part of the cultivated oats known as *Avena sativa*. On the contrary, it seems to the author unlikely that *A. strigosa* should have been derived from *A. barbata* (as TRABUT and ZADE suppose), for that would imply a decrease, difficult to admit, in the number of chromosomes during the course of phylogenetic development, and it seems to him more likely that it is *A. barbata* which has sprung from *A. strigosa*.

Finally the author gives the genealogical tree of the species of *Avena* which seemed to him most probable and in which he indicates in small square the numbers of chromosomes conferring on each species its phy-genetic character.

Parent	<i>Avena strigosa</i>	14	. . .	<i>A barbata</i> ?	28	
from						
unknown	?	28	<i>A. sterilis</i>	42	. . . <i>A. byzantina</i>
origin	?	28	<i>A. fatua</i>	42	. <i>A. sativa</i> 42

860 - Observations on Hybrids between Cultivated and Wild Oats. TSCHIRMAK ¹², in *Zeitschrift für Pflanzenzüchtung*, Vol. VI, Part 34, pp. 207-209, Berlin, Dec., 1908

In hybrids between cultivated oats and wild oats (*Avena fatua*) the following facts are observed :

(1) There is a close connection ("linkage") between the two characters of the wild form "tendency for the spikelets to detach themselves from the rachis at the time of ripening" = M_1 and "Complete development of awns" = M_2 .

(2) On the other hand, there is incompatibility of coexistence between the character "hairy-ness of the glumes" = m_3 , peculiar to wild forms, and the character "yellow glumes" = m_4 , peculiar to cultivated forms.

(3) There is equally incompatibility of coexistence between the character "brown glumes" = M_4 , peculiar to wild forms, and the character "glabrous glumes" = m_3 , peculiar to cultivated forms.

In F_1 , the following types are noted :—

- (1) Predominance of the character "spikelets adherent to rachis".
- (2) Intermediate state of development of awns.
- (3) Intermediate state of hairy-ness of glumes.
- (4) Predominance of the brown colour of the glumes.

In F_2 there are only 4 types :

(A) Spikelets easily detached from the rachis, with complete development of awns, as in the wild forms.

Type 1 : — Glumes brown, very hairy.

Type 2 : — Glumes yellow, glabrous.

(B) Type 3 : — As in F_2 .

(C) Type 4 : — Spikelets adherent to the rachis, slightly bearded (very variable character); glumes yellow, glabrous, as in cultivated forms.

The only successful combinations are :—

$[M_1 M_2] [M_3 M_4]$, $[M_1 M_2] [m_3 m_4]$, next $M_1, < m_1 M_2, < m_2 M_3 < m_3$, $M_4 > m_4$ and lastly $[m_1 m_2] [m_3 m_4]$ to the exclusion of the combinations $[m_1 m_2] [M_3 M_4]$, $[M_1 M_2] M_3 m_4$ and $[M_1 M_2] M_3 m_4$.

Except for the above mentioned affinities there is incompatibility between the groups $[m_1 m_2]$ and $[M_3 M_4]$ and on the other hand affinity of the group $[M_3 M_4]$ with the group $[M_1 M_2]$. Limiting schematically the idea "wild form" to the two characters "spikelets detachable" and "beards complete" = $[M_1 M_2]$ and the idea "cultivated form" to the two characters "spikelets adherent" and "beards slightly developed" = $[m_1 m_2]$, the following scheme is obtained (FC = cultivated form, FS = wild form and I = intermediate form):—

P	FC × FS
F ₁	I (generally with the character "spikelets adherent" char- acteristic of FC predominat- ing).
F ₂	4FS : 9I : 3FC.

In F_2 the wild forms FS of F_2 are transmitted without change; of the 9 individuals with intermediate characters, of F_2 , 4 detach themselves according to the ratio 4 FS : 9 I : 3 FC; of the 3 individuals FC of F_2 , 1 remains constant and the 2 others detach themselves according to the ratio 3 FC : 1 FS.

To explain the behaviour of F_2 , either the effect of the presence or absence of 2 factors (FS = ABAB — FC = abab), may be allowed or differences in the grouping of 3 factors which in the original wild form would be united = \widehat{ABC} and on the contrary in the original cultivated form would be separated = $A \downarrow B \downarrow C$.

The second hypothesis seems best to explain the above mentioned phenomena; in fact, among the products of separation of F_2 , $\widehat{ABC} \widehat{AB} \downarrow C$ and $\widehat{AB} \downarrow C \widehat{AB} \downarrow C$ still present the phenotype of the wild form, whereas $\widehat{AB} \downarrow CA \downarrow B \downarrow C$ still presents the phenotype of the cultivated form.

In F_2 the representatives of the wild form with brown hairy glumes, and those of the cultivated form with yellow glabrous glumes are in the ratio 3 : 1; the intermediate forms have brown semi-bearded glumes, finally the representatives of the wild form have all yellow glabrous glumes and some of them separate themselves in F_2 into 3 FC with yellow glabrous glumes : 1FS with yellow glabrous glumes. It follows that the combination $Ab Ab (\widehat{AB} \downarrow C \widehat{AB} \downarrow C)$ belongs to the group "glabrous yellow" and that in F_2 the two groups of characters "hairy-brown" and "glabrous-yellow" ought to be in the proportion 12 : 4 = 3 : 1, which is really the case.

CONCLUSIONS.— These phenomena of association and dissociation of characters tend to show that the appearance of characters of the wild form

in cultivated oats (such as detachable spikelets with completely developed awns and with brown hairy glumes) may be due to a bud mutation. It would be a case of "associative atavism" by which $A \overline{B} \overline{C}$ would revert to $\widehat{AB} \overline{C}$ or to \widehat{BAC} .

The complication observed in the correlation of some characters would be due to one or more factors of the colour (brown or yellow) of the glumes.

861 - Linkage between Certain Characters of Maize; Investigations in the United States of America. — JONES, D. F. and GALLASTEGUI, C. A. (Connecticut Agricultural Experiment Station), in *The American Naturalist*, vol. LIII, No. 626, pp. 239 246, bibliography of 10 publications.

The variety of maize known in the United States as "pod corn" (*Zea Mays* var. *tunicata* Sturtevant), is characterised by the abnormal development of the glumes, which cover the grain completely. In 1917, COLLINS after a series of genetic investigations was able to establish that "pod corn" is not a pure type but a heterozygous condition more or less analogous to that of the blue Andalusian fowl, and the work done by the authors has confirmed the opinion of COLLINS.

A certain number of plants of typical "pod corn" were artificially self-fertilised and the grains produced by each were sown separately. The progeny was of three different types:—

- (1) About half were identical with the parent plant (podded).
- (2) One quarter were of the normal non-podded type.
- (3) One quarter were of an abnormal type, not producing lateral inflorescences, but producing a bisexual terminal inflorescence instead of the male inflorescence of the normal type.

This terminal inflorescence produced very little fertile pollen, for which reason efforts to self-fertilise were unsuccessful, grains produced being apparently due to cross-fertilisation by pollen of other plants.

When these seeds were sown separately the progeny was mostly of the podded or semi-podded types.

One of the semi-podded type ears was self-fertilised and produced grains of 2 kinds, starchy and sweet, which shows that the pollen which fertilised the parent plant must have come from a sweet maize seed.

Since all podded maize is starchy and all sweet maize is non-podded, the two characters "podded" and "starchy grain" should evidently have come from the female parent and the two characters "non-podded" and "sweet grain" could be imputed to the male parent.

The ear in question had 216 seeds of which 174 were starchy and 43 sweet, numbers nearly in the ratio of 3 : 1. All these 216 seeds were sown, starchy and sweet separately, but only 149 ripe plants resulted, so that the numbers of grains belonging respectively to each class had to be corrected according to the theoretical ratio 3 starchy : 1 sweet; this was done in the following table which indicates the components of the progeny produced:—

	Number of plants bearing grain			
	Starchy podded (I)	Starchy non-podded (II)	Sweet podded (III)	Sweet non-podded (IV)
Number found	113	4	7	25
Corrected to ratio 9 starch:1 sweet	108.0	3.8	8.2	29.1
Corrected to gametic ratio 11 : 1 : 1 : 1	105.8	6.0	6.0	31.3

Since it was a case of crossing in which the two parents differed in 2 characters (covering of the seed and composition of its endosperm), the ratio between the 4 types in F_2 ought to be 9 : 3 : 3 : 1, but, as the table shows, the plants in groups I and IV greatly outnumber those in groups II and III. This is an interesting case of linkage between the characters "starchy" and "podded", and between the characters "sweet" and "non-podded".

Two characters are said to be "linked", when, found in the same chromosome, they remain always associated as if they formed a single indivisible element, whether they transmit or group themselves in any manner, or whether they go through the processes of meiosis up to the formation of germinal cells or gametes.

In this particular case, if "the linkage" was complete, groups II (plants with starchy, non-podded grain) and III (plants with sweet podded grain) ought not to exist and F_2 ought to consist of only two groups or pairs of characters I (starchy, podded grain) and IV (sweet, non-podded grain).

But, in fact, there are 4 plants with starchy, non-podded grains and 7 plants with sweet, podded grains, which shows that the phenomenon of "linkage" is modified by that of "crossing over" (1), which may be represented in the following manner: - Suppose that the factors of the characters "starchy" and "podded", on one side, and the factors of the characters "sweet" and "non-podded" on the other are situated at the two extremities of their respective chromosomes. Suppose, again, that during the process of allotypic division these 2 chromosomes divide transversely in two and that an exchange of segments takes place, so that the half-chromosome containing the factor of the character "starchy" goes to fuse (forming a single chromosome) with the half-chromosome containing the factor of the character "non podded" and that, on the other hand, this fusion takes place between the half-chromosome containing the factor "podded" and the half chromosome containing the factor "sweet". Thus 2 chromosomes would be produced leading to the formation of gametes and consequently of plants having the two characters "starchy" and "non-podded" or the two characters "sweet" and "podded".

The more frequently the phenomenon of "crossing-over" takes place,

(1) See *R. Jan* 1918, No 20, p 54, note (1) (*Ed*)

the greater will be the number of plants belonging to the two types "starchy non-podded" and "sweet podded".

In the case investigated there were, out of a total progeny numbering 149 plants, $4 + 7 = 11$ plants of these two types, which corresponds to 8.3 % of "crossing-over".

862 - A Case of Mutation in a Pure Line of *Phaseolus angularis*, in the United States of America. — BIAKFSLEP, A. I., in *The Journal of Heredity*, Vol. X, No. 4 pp. 153-155, 1 fig. Washington, April 1919.

Phaseolus angularis (adzuki bean) has typical leaves with three leaflets. The author describes a plant characterised by unifoliate leaves; it appeared unexpectedly in a pure line of 1500 plants grown in 1918 and descended from a plant selected in 1913. Besides the structure and form of its foliage this plant differed in the following characters from the plants grown with it: — (1) It was taller and more branched; (2) it retained its leaves longer; (3) it bore flower buds but they dropped off before opening, leaving the rachis bare.

This mutation is extremely rare: out of 450 000 plants under careful observation it has only once been noticed; it cannot either be considered a "new combination" of characters, or as a fluctuation; in either case there should have been a much greater frequency. It must therefore be a mutation.

The Leguminosae are predominately characterised by compound leaves. A few genera are exceptions: — *Cercis*, *Crotalaria*, *Genista* and the species *simplex* of the genus *Rhynchosia* bear simple leaves.

It has not yet been decided with any certainty which of the two forms is the primitive one. If the true primitive form of leaf in the Leguminosae is the simple one the unifoliate type in question would be a reversion to an ancestral type; in the contrary case it would be a progressive mutation.

863 - Selection of Potatoes in Standing Crops at the Central Experimental Farm at Ottawa, Canada. — MACOUN, W. T. in *Dominion Ministry of Agriculture Canada — Dominion Experimental Farms, Horticultural Branch, Bulletin*, No. 90, pp. 15-16, 2 tab. Ottawa, 1919.

The central experimental Farm, Ottawa, has made some selection experiments with standing crops of potatoes the results of which at first marked a considerable increase in yield; but when the temperature made it difficult to get vigorous tubers the advantages of the previous selection were lost. It is therefore recommended to select vigorous tubers every year.

The first table (p. 867) shows the advantages obtained from a first selection of the finest plants made in 1905 on 5 different varieties.

In 1906, the best plants of the kinds experimented with (except Carman No. 3) were again selected, and in 1907 the yield of their progeny was compared respectively with the yield obtained from progeny of tubers which had not been selected after 1905, and that of tubers which had never been subjected to selection. The second table shows the results of the comparison.

Kinds	Selected Yield per hectare	Not selected Yield per hectare	Difference for (+) or against (—) selec- tion
Clay Rose	16 260 kg.	12 620 kg.	+ 3 540 kg
Rural Blush	15 970	11 830	+ 4 140
Gold Coin	14 190	12 420	+ 1 770
Morgan Seedling	14 190	11 830	+ 2 360
Carman No. 1	13 000	13 900	- 900
State of Maine	12 270	9 050	+ 3 670
Carman No. 3	9 050	9 050	—
<i>Averages</i>	13 626 kg	11 543 kg.	+ 2 083 kg

Kinds	Selected in 1905 and again in 1906 Yield per hectare	Selected only in 1905 Yield per hectare	Never selected Yield per hectare
Clay Rose	7 390 kg.	9 760 kg	9 460 kg
Rural Blush	11 235	12 420	7 690
Gold Coin	5 915	4 435	6 800
Morgan Seedling	3 550	5 320	7 690
Carman Mo. 1	8 800	8 260	6 500
State of Maine	3 550	4 730	3 550
<i>Averages</i>	6 130 kg.	7 490 kg	6 940 kg.

The results obtained in 1907 might have been more in favour of selection if the tubers used had been of better quality, but the season 1906 was, for potatoes, one of the worst known up to the present time: the stalks withered early owing to drought, the tubers were small or wanting in vitality, and the plants grown from them developed irregularly and without vigour. As a result, as the above table shows, the tubers selected in 1906 from those selected in 1905 produced in 1907, owing to their want of vitality, a smaller average than the progeny of the tubers selected only in 1905 and even less than the progeny of tubers which had never been selected.

When cultivators who have used selection with success get results of this kind, the author recommends them to change their plants, that is to say to use tubers of greater vitality obtained from another source and to recommence selection entirely. Selection in standing crops, recommenced at Ottawa in 1910, was discontinued 3 years later on account of the poor results given by sets which had lost their vitality. On the other hand, investigation by selection in standing crops is continued at all the other Farms and Experimental Stations in the Dominion and will no doubt give interesting results.

64 - **Bud Variations in Sugar Cane and their Use.** — POMEROY C. S., *The Journal of Heredity* Vol IX, No 3, pp 129-135, 2 pl Washington, March, 1919

The author studies these bud variations as starting points in the crea-

tion of new kinds of sugar cane of commercial value, following the example of numerous kinds of orange, cotton, etc. similarly obtained.

These bud variations, which have previously been studied in Louisiana (United States), in the West Indies, in Mauritius and in Australia, may be grouped in the following manner : --

I. CANES BEARING SHOOTS OF A DIFFERENT COLOUR. — Two cases may be met with : — (1) Striped canes producing variations of plain colour ; (2) Canes of plain colour producing striped variations.

(1) The variety "Striped Tanna", introduced long ago into Mauritius, often produces 2 bud variations, one plain yellow, called "White Tanna" and the other purple, called "Black Tanna".

In 1910, the former was cultivated largely in Mauritius and in the Hawaiian Islands (unirrigated plantations) under the name "Yellow Caledonia" and in the Fiji Islands under the name "Malabar".

The variety "Red Cheribon", striped yellow and red, has produced by bud variation, two kinds of plain colour "White Cheribon" (pale) and "Black Cheribon" (dark).

(2) The variety "Louzier", plain yellow (produced by a mutation of the striped red and green kind "Mignonne"), was able to produce, by bud variation, kinds regularly striped green and red (like "Mignonne") and kinds irregularly striped green, red and yellow.

II. RHIZOMES PRODUCING SHOOTS OF DIFFERENT COLOURS. — MELMOTH HALL mentions the case of a rhizome of the Ribbon variety which, along with normal Ribbon shoots, produced also shoots which were entirely yellow and others entirely green.

III. STALKS WITH SOME INTERNODES STRIPED AND OTHERS OF PLAIN COLOUR. — In New South Wales (Australia), JAMES CLARKE found a cane of the "Striped Tanna" variety whose lower internodes were striped (normal) while the upper internodes were plain yellow ("White Tanna" type).

IV. ORIGIN OF TYPES CHARACTERISED BY GREAT VIGOUR AND RICHNESS IN SUGAR. — In Mauritius alone there are 8 or 9 kinds of sugar cane raised by bud variation ; some of them, cultivated on a large scale, are superior to the original types in strength and yield of sugar. These new varieties come from kinds recently introduced into the island and it is probable that they are due to this change in environment, which would have influenced the habit of the plants.

The types produced by bud variation transmit, agamously, to their descendants their good and bad characters without alteration. It goes without saying that we can profit by this fact in efforts to improve sugar cane, but on the other hand it is necessary to select the reproductive material very carefully and prudently, so as to avoid the propagation of types of little value. A good many of the kinds of sugar cane widely cultivated owe their origin to bud variation. This is noticeably the case of the "Louzier" variety produced in Mauritius about half a century ago by a mutation of the variety "Mignonne" (described above) and which several writers consider identical with the varieties "Yellow Otaheite", "Bourbon"

and "Luhaina;" it has now spread over all tropical regions from Mauritius to the Dutch Indies, Cuba, the West Indies and the Hawaiian islands.

865—Behaviour of "aurea" Character in Hybrids of a Cross between Two Varieties of *Nicotiana rustica*; investigations in the United States of America.

— ALLARD H. A., in *The American Naturalist*, Vol. LIII, No. 626, pp. 234-236. Lancaster Pa., May-June, 1919.

The author gives the name *aurea* to a variety of *Nicotiana rustica* from Russia (S. P. I. 35080) characterised by the white colour of the stalk and midrib and yellowish green leaves. A section of the stalk shows that the whiteness is not superficial but extends entirely through the stalk. By these characters, the variety *aurea* differs clearly from other varieties of *N. rustica* whose stalk and leaves are completely green.

By crossing the variety *aurea* (vv) with the normal green type (VV) hybrids (Vv) were obtained in F_1 ; these were all green which shows that the character *aurea* is recessive.

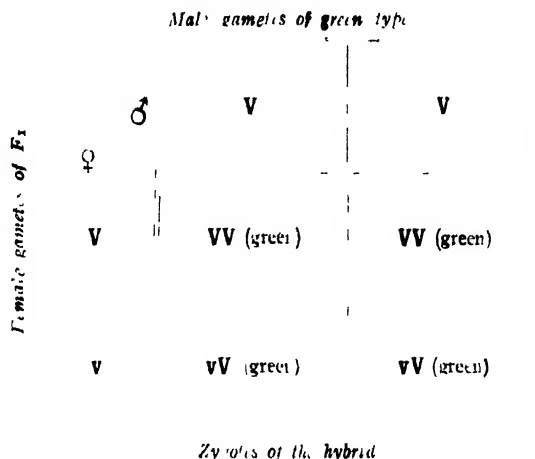
The F_2 generation included both green and white-stemmed *aurea* plants in the ratio of monohybridism 3 : 1. Of the green plants the greater number were heterozygous (Vv or vV) but some were homozygous (VV). In F_3 , the green heterozygous plants of the F_2 generation divided in the ratio 3 green : 1 *aurea*, while the green homozygous plants and the *aurea* (vv) plants respectively gave progeny exclusively *aurea*.

The existence of these gametic relations was confirmed by crossings between the hybrids F_1 and each of the two parents.

Thus the cross $F_1 \times \text{aurea}$ represented by the gametic formula $Vv \times vv$ gave 591 plants, of which 303 were green and 288 *aurea*, numbers corresponding nearly with the theoretic ratio 1 : 1, the existence of which is illustrated in the following diagram :

		Male gametes of the aurea type	
		♂	
Female gametes of F_1		v	v
	+		
V		Vv (green)	Vv (green)
v		Vv (aurea)	Vv (green)
		Zygotes of the hybrids	

On the other hand the cross $F_1 \times \text{green}$ (*Nicotiana rustica* from India) represented by the gametic formula $Vv \times VV$ gave 280 green plants as illustrated by the following diagram : —



CONCLUSION. These crossings are easy to carry out and give hybrids with clear characters 5 or 6 weeks after germination; they are therefore specially suitable for the demonstration of simple Mendelian laws.

**CEREAL
AND
ULSE CROPS**

866. **Contribution to the Study of Autumn and Winter Cereals.** — GASSNER, GUSTAV in *Zeitschrift für Botanik*. Year X. Part 8, pp. 417-480. Jena, 1918.

ROLE OF LOW TEMPERATURES. — The difference between autumn and spring cereals consists in their respective behaviour relatively to low temperature; to form ears and fructify, autumn cereals have to pass through a cold season.

The action of low temperature has positive effects even when it is limited to the phase of germination. In fact autumn wheat, rye and barley, even when sown in spring, produce plants forming ears and fructifying in a regular manner if they are then subjected to a sufficiently low temperature.

The difference between autumn and spring cereals is therefore not due to the difference in the length of the vegetative period but to the collective thermal requirements. The need of low temperatures ("Kältebedürfniss") is directly correlated to resistance to minimum temperatures in winter, that is to say that resistance is greater in proportion as it is needed and consequently that the "autumn" character is more marked.

The author has arrived at these conclusions after a series of experiments carried out in the following manner: — seeds of cereals were placed to germinate in special germinators measuring 12 cm. in diameter containing moist quartz sand, and divided into 4 groups which were exposed respec-

tively, for at least 48 hours, to the following temperatures: 1st group 1—2° C.; 2nd group 5-6° C.; 3rd group 12° C.; 4th group 24° C.; as soon as germination was complete the 20 best seedlings were taken out of each germinator, their roots were cleared of adhering sand and they were replanted in fives in pots containing compost; these were left in the shade for one day and they were then buried in the same plot in as uniform conditions of light as possible.

The different stages of growth of the plants were subject to daily observation and the respective dates of coming up, tillering, earing, flowering, fertilisation, formation and ripening of seed were noted.

RYE. — For each of the two kinds tested (autumn Petkuser and spring Petkuser) the sowings were divided into 4 lots treated in the following manner:

Lots	Successive sowings	Germination temperatures
I	From 10 January to 9 May	1° to 2° C
II	From 10 February to 9 June	5° to 6° C
III	From 21 February to 20 June	12° C
IV	From 26 February to 3 July	24° C

The results obtained are briefly as follows: —

(1) *Spring Petkuser*: The different germination temperatures made no difference in the growth of the plants, for, independently of these temperatures, all plants germinating at the same time also formed ear and ripened simultaneously.

(2) *Autumn Petkuser*: The different germination temperatures, on the contrary, caused very distinct differences in the growth of the plants; thus, plants produced by the latest sowings (April 22, May 2 and 9) were not able to form ears regularly unless they had sprung up at a temperature of 1-2° C. On the other hand, plants which had sprung up at 5-6° C. only formed ears more or less regularly if they had come up before the end of April in order that plants which came up at 12° C. should form ears it was necessary that they should have sprung up before the middle of April finally for plants which germinated at 24° C it was requisite that they should have sprung up before the end of March, that is to say when the subsequent temperatures were still sufficiently low to satisfy the "need of cold" ("Kältebedürfnisse") of the plants in the early stages of their growth.

Plants which germinated at the same time formed ears more quickly when their germination temperatures was lower. Thus, plants sprung up the middle of March at 1°-2° C. formed ear respectively 9, 21, 41 days sooner than plants sprung up at 5°-6°, 12° and 24° C.

BARLEY. — The kinds studied, Friedrichswerther Mammuth (autumn) and Heines Hanna (spring) gave results similar to those obtained for rye.

WHEAT. — The kinds studied were Svalöf Extra-Squarehead II

(autumn); Kittnauer (autumn spring); Rimpaus Roter Schlanstedter (spring); Heines Kolben (spring). The 1st and the 4th represent extremes.

The 1st, with reference to the effect of germination temperatures on the subsequent formation of ears, behaved like autumn rye. The 4th, on the contrary, behaved exactly like spring Petkuser rye and Heines Hanna spring barley; plants germinated at the same time also formed ear simultaneously whatever the germination temperature had been.

The Kittnauer variety is intermediate between Extra-Squarehead and Heines Kolben but is nearer to the former.

Finally the Roter Schlanstedter variety, though it is a spring wheat, is also intermediate between Squarehead and Kolben: it needs a period of low temperature for its regular growth and it yields a heavier crop when it is sown very early in spring; this is the more easy of explanation since it was derived, by a series of successive adaptations, from a French autumn wheat.

All these experiments demonstrate therefore the correctness of the principles stated at the commencement of this article on the subject of the differences between autumn and spring cereals.

THERMAL CONDITIONS FROM AN ECOLOGICAL POINT OF VIEW. — In his "Physiological research regarding the influence of temperature on germination", SACHS has named *optimum* temperature that which insures the most rapid growth, while *minimum* and *maximum* temperatures constitute the limits outside which all phenomena of growth become impossible. But PFEFFER had already observed that the collective factors which produce the most rapid growth are not always such as to favour best normal and complete development of the plant. Thus, spring cereals exposed during the early weeks of the period of growth to the optimum temperature of growth later present a sickly appearance recognisable by the leaves turning yellow prematurely. According to KRASAN, the phenomena of metabolism which lead to the formation of the floral organs are only produced when the temperature descends below a certain limit, more often below the minimum temperature of growth.

We are thus led to admit the existence of a "thermic ecologic optimum" (as opposed to the "thermic optimum of growth" of SACHS), that is to say of temperatures most favourable to the normal development of the plant in its various stages up to the formation of flowers and fruit. This "thermic ecologic optimum" evidently varies according to the said stages and in the case of autumn cereals, as has been seen above, it descends very low; but it is not possible to determine it absolutely for each of the different stages, owing to the connection which exists between all the phenomena of growth from germination to maturity. Thus, autumn rye exposed artificially to low temperatures during germination forms ears and flowers regularly even when sown in spring. In this case the ecologic optimum for the stage in which leaves are formed and for the development of culms may be relatively high. If, on the contrary, germination takes place at a high temperature it would be necessary to expose the plant to low temperatures during the stage following germination, that is dur-

ing the formation of leaves and culms, in order to obtain normal development of flower. In this case a high germination temperature producing rapid germination is no longer harmful and does not exceed the ecologic optimum.

EFFECT OF LOW TEMPERATURE ON FLOWERING. — The author first discusses the ideas on this subject put forward by FRUWIRT, KRASAN SACHS, LOEW, FISCHER, etc., and then reviews the important work of KLEBS, according to whom the change from vegetative growth to reproduction is closely connected with an excess of carbohydrates (reserve material) compared with nitrogenous matter. The antithesis between vegetative growth and reproduction pointed out by SENDTNER is thus explained; the former would be connected with a decrease in the activity of assimilation, while the formation of sexual organs would, on the contrary, admit of the predominance of that activity.

Thus, the experiments made with autumn rye have shown that for plants growing in an atmosphere in which lack of carbonic acid gas (artificially removed) hindered assimilation, flowering did not take place even if during germination the action of low temperature was brought to bear.

On the contrary, in a normal atmosphere (containing carbonic acid gas), low temperature tended to increase in the plants the concentration of sugar and thus favoured the formation and growth of the sexual organs; this concentration was greater when the temperature was lower.

The recent studies of LIDFORSS, MAXIMOV, AKERMAN, etc., have shown that the resistance of plants to cold increases in proportion to the sugar concentration of their sap. There is therefore correlation between the "need of cold" of plants and their resistance to low temperatures; these, by increasing the sugar concentration influence, both resistance to cold and the development of sexual organs.

PERIODICITY OF PHENOMENA OF GROWTH OF PLANTS. — On this subject there are two opinions; that of KNIER and that of KLEBS. According to KNIER (and the greater number of existing physiologists), periodicity is an internal hereditary phenomenon, which PFEFFER considers as an "autonomous or autogenous activity" of the plants.

On the contrary, according to Klebs, the hereditary phenomenon would not be an autonomous rhythmical action, but a "specific structure" of the plasma which, in conjunction with "internal" and "external" conditions, would produce the periodicity observed each year.

The "autumn" and "spring" characters of cereals which show themselves in a different length of the vegetative period cannot be considered as a hereditary peculiarity independent of the action of external causes. It is no longer possible to admit the heredity of a specific "autonomous" length of vegetative period, since it has been shown that these phenomena can be very easily artificially modified or suppressed. On the other hand, the peculiarities which under the action of climatic factors determine the real "natural" length of the vegetative period can be considered as hereditary; "resistance to cold" and "need of cold" might be counted as among these peculiarities. However, in view of the variability in resistance

to cold observed at different stages of development of plants and according to variations in environment we should rather speak of a specific aptitude to produce, in certain conditions of environment, a greater or less degree of "resistance to cold". We can consider "need of cold" in a similar manner: the flowering of autumn cereals is conditional on the action of low temperature which always decreases up to extinction, according as the lighting and the quantity of carbonic acid gas are diminished; the character "need of cold" is, therefore, neither autonomous nor hereditary; we ought rather say, the autumn cereals possess a natural tendency to react to the action of external factors so that the formation of flowers appears subordinated to such and such low temperature.

We are thus led to this conception of biologists and still more of genetists: — "that which is transmitted hereditarily has always a specific manner of reacting to environment, and the external characters perceived by our senses are only the result of that reaction to the eventual grouping of the external factors in presence of which the individual considered has developed" (BAUR).

It is therefore not "periodicity" as such, which is transmitted hereditarily but rather a peculiar aptitude of the organism to react with a certain natural rhythm (periodicity) to the natural conditions of environment.

867 - **Wheat-Growing in Kansas.**—CALI, E. F. and SALMON, C., in *Agricultural Experiment Station, Kansas State Agricultural College. Bulletin* 210, 51 pp., 11 fig. Topeka, 1916

A detailed account of wheat-growing in Kansas together with advice as to the best practical methods to be adopted in order to make the crops more certain, and so reduce the losses and the cost of production, and obtain maximum yields of the best quality at a reasonable cost

The statements set forth are based largely on experimental evidence secured from the Agricultural Experiment Station at Manhattan, the four branch Stations connected with the latter, numerous cooperative experimental tests with farmers throughout the State, the recorded history of nearly 60 years of wheat-growing in Kansas, and the experience of practical farmers generally.

Most of the wheat produced in Kansas is grown in the central part of the State, and practically all of it is winter wheat. Hard varieties do best in Central and West Kansas, while soft wheats succeed in the East. Soft wheats are usually less drought and cold resistant than hard wheats and are more easily injured by hot winds. On the other hand, they lodge less in wet seasons and humid climates.

The new variety of winter wheat called Kanred (1) recently produced at the Manhattan Agricultural Station, yields on an average 4.5 bushel per acre more than Turkey and 4.7 bushels more than Karkof. These last named varieties are those generally grown in Kansas.

A strain of Fulcaster, a soft wheat produced by the Missouri Experiment Station, has given the best yield of all varieties tested in Southeastern

(1) See *R*, Feb 1919, No 159 (Ed).

Kansas. In Northeastern Kansas, a soft wheat (Harvest Queen) has given practically as good results as Fulcaster, in fact many farmers prefer it to the latter, because it is a beardless wheat.

The writers recommend the following rotation for central Kansas : lucerne (years 1-8) ; early kafir, or early amber sorghum (year 9) , maize (year 10) ; oats, barley, or winter wheat (year 11) , wheat on land ploughed early (year 12) ; wheat (years 13 and 14) ; kafir or sweet sorghum (year 15) ; maize (year 16) , and then the rotation must be repeated, beginning however with 8 years of lucerne. Farmyard manure is the most satisfactory fertiliser for wheat.

868 - Indian Wheat Sown in the Department of the Gironde, France. — RACHTEL SÉVERIN, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol V, No 17, pp 520-521. Paris, May 1919

The author presents the Academy with a specimen of the first ears of Indian wheat (raised from seed sent by M. L. KULKARI, Director of Agriculture, Bombay, and produced in plots at the experimental station at Poona), which had been sown in the Gironde on November 20, 1918. Unfortunately, last winter was continuously damp and this wheat, which is very early, showed itself very liable to rust, which completely destroyed it.

869 - Comparative Cultural Tests of 11 Varieties of Oats at Domnarvet, Central Sweden, from 1905 to 1917. — NILSSON, GEORG in *Sveriges Utsädesförmåga och Tidsskrift*, Year XXIX, Part 1, pp 37-41. Malmö, 1919

These cultural tests aimed at a comparison of the varieties: - Svalöfs Dala, Common Dala, 01161, 01163, Björn, Orion, Mesdag, Nordfinsk, Seger, Guldregn, Ligowo, of which the first eight are early and the last three of medium earliness. Svalöfs Dala, 01161 and 01163 are derived from crosses of Guldregn \times Svalöf Dala and are characterised by being about as early as Dala and at the same time more productive and with stronger straw; the grain of 01161 is white and that of 01163 yellow.

The Björn oat of Svalöf, produced from the cross Ligowo \times Nordfinsk black oat, is earlier than Ligowo, it yields well, it has strong straw and its grain is black.

Orion is another oat also produced at Svalöf from the cross Ligowo \times 0668 (0668 is a line of Merö oats). It is early, its grain is of good quality, and, in the Central and Northern parts of Norrland, its yield is really high.

YIELD OF GRAIN AND STRAW. - Seger holds first place with 3129 kg. per hectare and a yield index of 106.5 (Guldregn = 100). This variety grows as far north as the 60th parallel of latitude, in the southern districts of Dalarna, but there it quickly loses its earliness and gives place to Guldregn, which is earlier.

Ligowo oats are clearly inferior to the two kinds noted above: its index of production = 92.6.

In the least favourable parts of Dalarna the Guldregn variety is too late and should be replaced by other kinds, for example, by oat 01163 derived from the cross Guldregn \times Svalöfs Dala.

Yield and quality of grain

Kinds	Yield of grain per hectare		Percentage of naked grain in unhusked grain	Weight of 1000 grains gm.	Weight of hectolitre kg.	Percentage of double grains
	Un-husked	naked				
0355 Seger	3129	2299	73.5 %	35.5	52.3	1.17 %
0386 Guldregn	2937	2235	76.1	33.2	53.6	0.19
9353 Ligowo	2719	2061	75.8	39.5	52.5	0.65
0924 Selected Dala	2842	2051	73.3	27.6	50.8	0.73
— Common Dala	2622	1974	70.4	27.0	46.0	1.53
01101 of 0924 X 0386	2607	1935	75.3	31.4	52.0	0.46
01163 of 0924 X 0386	2572	1885	74.9	33.8	50.4	0.43
01120 Björn	2513	1811	74.4	30.9	48.0	0.93
01101 Orion	2527	1779	72.1	35.4	48.1	0.50
— Mesdag	2460	1773	72.1	33.2	49.7	0.93
— Nordfinsk	2245	1602	71.4	27.2	45.9	2.82

The very early varieties Björn (2607 kg. per ha.) and Orion (2513 kg. per ha.) are better than Nordfinsk (2245 kg. per ha.) by 17.4 % and 9.2 % respectively. In production of straw, Seger again takes the first place (4551 kg. per ha.) and Guldregn comes next (4518 kg.); Orion is among the last with 3082 kg.

QUALITY OF GRAIN. — The following characters are considered: — percentage of naked grain to unhusked grain — weight in gm. of 1000 grains — weight in kg per hectolitre — percentage of double grains.

Guldregn stands at the head of the list for weight per hectolitre, while the indigenous oats Nordfinsk and Common Dala are among the last. Ligowo has larger grains and consequently has a high weight per 1000 grains, Seger and Orion follow it closely, the latter having precisely the character of Ligowo.

The percentage of naked grain is certainly a very important character; for this, Guldregn holds the first place with 76.1 %, and if the yield is expressed in naked grain the difference between Guldregn and Seger is considerably reduced. Comparing the data on the quality of Domnarvet grain with that of Ultuna, the weight per hectolitre, the weight per 1000 grains, and the percentage of naked grain are all clearly inferior in the latter place. The quality of the grain, provided ripening is certain, improves as it is grown further north.

EARLINESS. — This is a character whose importance is more and more manifest as the latitude and altitude increase; a gain, of even a few days, in ripening considerably reduces the risk of early autumn frosts.

Among the three fairly early varieties tested, Ligowo and Guldregn are equally early; Seger on the other hand ripens some days later; this is why Guldregn is more cultivated in Dalarna.

Of the early kinds, on the average, Mesdag ripened 10 days and Svalöfs Dala 6 days before Guldregn. Generally, the other varieties were alike and were about as early as Svalöfs Dala.

870 -- **Chemical Composition of Natural Rice and of Italian Polished Rice. First note).** — ISSOCOLLO, G., *Estratto dagli Atti della Reale Accademia delle Scienze di Torino*, Vol. LIII, pp. 731-744. Torino, 1919.

The author, with a view to contributing to the study of the most rational utilisation of cereals, has undertaken numerous investigations on the qualities of the following kinds of rice, specially with regard to their phosphatic constituents: —

I. *Riso svestito rosso* (red hulled rice), composed of homogeneous grains covered with a red skin and perfectly white inside; the red colour is fairly resistant to acids but is entirely removed by alkalis, specially ammonia.

II. *Riso svestito bianco* (white hulled rice), which stands cooking well, giving out the characteristic smell of this cereal.

III. *Riso brillato perla* (polished pearl rice), formed of small, transparent, heavy grains, slipping easily over each other; stands cooking well but does not give off any agreeable odour.

IV. *Riso mercantile raffinato* (refined commercial rice), white, homogeneous, stands cooking badly, gives off no agreeable odour, insipid.

V. *Riso cremonese bianco* (white Cremona rice), similar to IV.

VI. *Riso cremonese striato di rosso* (red striped Cremona rice), used, with V, in experiments by Prof. GUARESCHI in the course of which pigeons and fowls preferred white Cremona rice.

VII. *Riso bianco mercantile* (white commercial rice), kind placed on the market in 1918; has the organoleptic characters of milled rices with negative characters of appetibility.

The following table shows the results of the analysis of each of these 7 qualities: —

	I	II	III	IV	V	VI	VII
Specific gravity . . .	1.441	1.426	1.456	1.430	1.428	1.438	1.435
Water	12.74 %	13.22 %	13.65 %	13.25 %	12.88 %	12.65 %	13.37 %
A-h	1.43	1.24	0.87	0.53	0.50	0.68	0.57
Fats	7.15	2.08	0.64	0.56	0.65	0.77	0.68
Nitrogen	1.53	1.37	1.25	1.27	1.30	1.51	1.28
Crude albuminoids . .	8.57	7.81	7.12	7.23	7.41	8.55	7.29
Cellulose	1.21	1.15	0.18	0.22	0.25	0.32	0.24
Pentosans	0.35	0.30	0.05	0.06	0.12	0.16	0.10
Starch	73.55	73.20	77.19	76.08	78.10	76.95	77.75
Total anhydrous phosphorus	0.84	0.68	0.26	0.24	0.38	0.46	0.29
Phytinic phosphoric acid	0.485	0.435	0.058	0.055	0.152	0.188	0.082
Lecithinic phosphoric acid	0.010	0.008	traces	traces	—	—	—
Phosphoric acid proportional to 100 parts of ash	58	55	30	45	62	67	50

The difference between hulled rice and milled rice is evident: the former is fairly rich in both mineral and organo-mineral phosphatic compounds while the latter is poor in these constituents: thus the amount of phosphoric pentoxide may be as high as 5 gr. per kg. in hulled rice, while it does not reach 1 gr. per kg. in refined polished rice; lecithinic phosphoric pentoxide is entirely absent from the milled rice, while in hulled rice in the form of phospholecithine, it is as much as 1 gr. of lipoid per kg.

It is also desirable to draw attention to the chemical affinity which exists between the phosphate derivatives and albuminous matter, from which comes the constant fact that rice rich in phosphates is also rich in albuminoids.

(comparative analysis of 1 gr. of whole rice and of 1 gr. of polished rice.

	Whole rice	Polished rice
Phosphorus	2.678 ‰	0.890 ‰
Potassium	2.469	0.690
Magnesium	0.865	0.270
Sodium	0.434	0.210
Calcium	0.266	0.080
Iron	0.144	0.070
Chlorine	0.115	0.150
	6.871 ‰	2.287 ‰

All this confirms the argument of Prof. GUARESCHI (1) that polishing decreases the valuable nutritive elements in rice.

871 - **The Amounts of Nutrient Substances Abstracted from the Soil by Rice. Experiments in Java.** — VAN ROSSEM, C. I. *The Amounts of the Principal Nutrient Substances Abstracted from the Soil by a Rice Crop*—II. *The Amounts of Nutrient Substances Abstracted from the Soil by the Rice Plant at Different Stages of Growth*, in *Mededeelingen van het Agricultuur-Chemisch Laboratorium*, No. XVII, Buitenzorg, 1917.

I. *The Amounts of the Principal Nutrient Substances Abstracted from the Soil by a Rice Crop.* — Twelve different varieties of rice coming from different regions of Java were examined, and the results of the investigations have been published in the *Mededeelingen van het Agricultuur Chemisch Laboratorium* (Communications of the Laboratory of Agricultural Chemistry), No. XVII, Chapter I. They show that the percentages of inorganic substances in water-free samples of paddy (the harvested part of the rice plant) differ little from one another. There were more differences between the waterfree samples of rice straw, while the differences between the water-free samples of roots from which the adhering particles of sand had been removed were still more marked.

(1) I. GUARESCHI. Sulla più razionale utilizzazione dei cereali con esperienze ed osservazioni sull'alimentazione col riso sbamato o naturale ed a diversi gradi di depauperamento e brillatura. *Atti della R. Accademia di Medicina di Torino*, 1918. (Ed)

The results also demonstrated that an average crop in kg. per hectare of:—

	paddy	straw	roots
Damp	3 160	13 020	6 480 (with sand adhering)
Air-dried	2 420	4 920	1 980 <i>idem</i>
Freed from water	2 130	4 460	880 (freed from sand)

removed from the soil in kg. per hectare : —

	paddy	straw	roots
Nitrogen	23.3	22.0	4.8
Potash	12.3	50.6	7.5
Phosphoric anhydride	12.1	11.4	1.5
Ferric oxide	1.4	42.7	35.7
Lime	1.5	13.4	3.0
Magnesia	4.4	5.6	1.4
Silica	148.7	939.1	91.4

In harvesting the rice-straw, almost as much nitrogen and phosphoric acid, and four times as much potash is removed from the rice fields as when the paddy alone is taken.

II. *The Amounts of Nutrient Substances Abstracted from the Soil by the Rice Plant at its Different Stages of Growth.*— The results of analyses of one variety of rice made at five successive stages of growth. This variety is much grown by the natives in the neighbourhood of the experiment field. The latter, which was never manured during the whole experiment, was constantly irrigated. It consisted of 24 similar plots, and each of the five samples was composed of rice gathered from one or more rows of 39 plants in 6 plots on the dates given below.

Number of sam ples	Date of harvest	Number of plants taken
1 (young plants)	Jan. 10. 1916	166 584
2	Feb. 9	3 393
3	Mar. 7	2 808
4	April 3	702
5 (mature plants)	May 6	702

The first four samples were not mature and could only be divided into leaves, stem, and roots. The seedlings were about 40 days old when planted out on December 25, 1915. Towards the middle of March, the plants began to flower; their growth was always regular; they were attacked by no diseases.

Table I (page 880) shows that during the growth of the rice plant, the nutrient substances mentioned were absorbed in a regular manner, not only by the stems and leaves, but also by the roots, until the time of fructification and ripening.

On the other hand, during the latter stage, the roots retained almost the same amounts of iron and manganese as before, but very little of the

TABLE I — 100 rice plants contained the following amounts of nutrient substances (in gr)

Substances	N ^o 1		N ^o 2		N ^o 3		N ^o 4		N ^o 5	
	harvested	Jan 10	harvested	Feb 9	harvested	March 7	harvested	April 3	harvested	May 6
	stem and leaves	• roots	stem and leaves	• roots	stem and leaves	• roots	stem and leaves	• roots	paddy straw	• roots
Nitrogen	0.031	0.015	1.57	0.35	3.65	0.48	7.06	0.74	7.24	0.83
Silica	0.109	0.222	9.12	3.22	29.83	6.36	90.94	12.19	31.38	14.10
Ferric oxide	0.012	0.059	0.41	1.39	0.49	2.70	1.05	4.19	0.28	5.80
Manganous-manganic oxide	0.005	0.004	0.11	0.06	0.19	0.10	0.56	0.18	0.11	0.24
Lime	0.002	0.004	0.06	0.07	0.02	0.11	0.14	0.16	0.84	0.13
Potash	0.073	0.044	2.04	0.93	4.28	1.50	7.06	1.92	2.30	1.96
Soda	0.0008	0.0004	0.01	0.04	0.03	0.10	0.35	0.14	0.11	0.17
Phosphoric anhydride	0.013	0.010	0.16	0.08	0.49	0.11	1.33	0.19	2.64	0.11
Chlorine	0.007	0.003	0.33	0.19	1.06	0.28	2.87	0.26	0.11	0.30
Sulphuric acid	0.023	0.019	0.61	0.31	2.03	0.60	4.76	0.98	2.58	1.05

* roots freed from adhering sand.

other substances which had served to build up the epigeal portions of the plant.

Table II shows the amounts of the different nutrient substances contained in 100 grains and 100 plants at the given dates.

TABLE II. — *Amounts (in gr.) of the nutrient substances in 100 grains and 100 plants.*

Substances	Grains	Plants				
		Nº 1 January 10	Nº 2 February 9	Nº 3 March 7	Nº 4 April 3	Nº 5 May 6
N.	0.034	0.046	1.92	4.13	7.80	13.61
SiO ₂	0.140	0.613	12.31	36.19	103.13	199.39
Fe ² O ₃	—	0.071	1.51	3.10	5.24	7.29
Mn ³ O ₄	—	0.000	0.17	0.20	0.74	0.70
CaO	—	0.006	0.13	0.13	0.30	1.14
MgO	0.011	0.117	2.97	5.78	8.98	0.80
K ₂ O	—	0.001	0.08	0.18	0.49	0.45
Na ² O	0.022	0.023	0.24	0.60	1.52	3.10
P ₂ O ₅	—	0.010	0.52	1.34	1.13	3.01
SO ₃	—	0.042	0.92	2.63	5.74	8.31

As regards the three chief nutrient substances, larger quantities of nitrogen and phosphoric anhydride were absorbed during ripening than at the earlier stages of development, whereas less potash was taken up.

Throughout the course of its development, the rice plant continues to absorb these nutrient substances.

In the periodical *Teysmannia* (year 1917 p. 428 et seq.) the above results have been compared with those obtained in other countries, but none of these data apply to Java.

In the same periodical (year 1918, pp. 311-315) Messrs C. VAN ROSSIEM and F. W. WERNER have given more complete data (based on the above results) respecting the composition of the grains and the young plants of the same variety of rice. These seedlings were 40 days old at the time of analysis, and had not yet been planted out. They were thus, analysed 16 days sooner than those first spoken of. A summary of this analysis was given in No. 296, R. March 1919.

872 - Results of Experimental Cultivation of Soya in the R. Colonial Garden at Palermo -- MATTEI, G. E., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. V, Part 1-2, pp. 3-34 (30-31), bibliography of 40 works. Palermo, 1919.

In 1918 an experimental culture of soy-beans was made at the Colonial Garden, Palermo, on a plot 350 sq. m. A variety was chosen with almost spherical seed, greenish yellow in colour, on the success of which it was safe to rely as small experiments had been made with it in the preceding years. The seeds were sown on March 29, in furrows at a spacing of 30 × 40 cm.; they germinated regularly about 10 days later. Two hoeings were made and between May and the end of August eight irrigations were given;

flowering commenced early in July and the seed was harvested on November 15. The entire period of vegetation was, therefore, seven and a half months. The plants reached an average height of 90 cm. Their growth was luxuriant; there was a normal development of nodules on the roots. On the 350 sq. m 51 kg. of clean seed was harvested, which corresponds to about 1450 kg. per ha., or a little more than 19 hl. This yield is considered quite satisfactory, all the more so as it could be increased by manuring. The beans, when cooked in differed ways, were found to have an agreeable taste.

873 - **The Arums of Madagascar.** — JUMELLE H., in *Annales du Musée Colonial de Marseille*, Year XXVII, 3 Third series, Vol. VII, Pt. 1, pp. 179-189 + 3 pl. Paris-Marseille, 1919.

The Arums (Araceae) are only scantily represented in Madagascar. Previously only 4 genera, with 1 species in each, had been reported and two other genera which the author studies in the present note, one of which is a genus new to science, only raises to 6 the number of species of this family hitherto known in that large island.

The 4 genera noted are *Pistia*, *Hydrosme*, *Typhonodorum*, and *Pothos*. The already known genus, now reported for the first time from Madagascar, is the Indian genus *Remusatia*; the new genus, created by the author, is *Carlephyton*.

Of these 6 genera, 5 belong to the tribe of the Arace and only one, *Pothos*, to the Acoreae.

(1) *Pistia*. — *P. Stratiotes* L., a floating plant with submerged roots and leaves on the surface. Found specially at Nossi-Bé and in the N. W. of the island, but is also met with elsewhere.

(2) *Hydrosme*. — *H. Hildebrandtii* Engler. This is, with *Tacca umbrarum* Jum. and Perr., one of the "Kabija-dolo" or "Kobitsodolo" of the natives. It grows in the sandy woods of Manongarivo, in the sandy damp woods of Ankirihitra and in the rocky calcareous woods of Mahevarano near Majunga.

(3) *Typhonodorum* — *T. madagascariensis* has been separated from *T. Lindleyanum* by M. ENGLER; the author does not consider this separation justified and thinks that the name *T. Lindleyanum* ought to be adhered to for the Madagascar species. This is the "viha" or "mangiba" of the natives, who make use of the fibre which they obtain from the leaves, and extract from the base of the plant a starch which they eat. The plant grows in marshes and on the edges of muddy watercourses and is from 1.50 m. to 2.50 m. high.

(4) *Remusatia*. — Doubtless *R. vivipara*, a species fairly common in the island.

(5) *Carlephyton*. — New genus created by the author; near the genus *Stylochitum*

(6) *Pothos*. — *P. Chapelieri* Scott, a plant climbing high up the trunks of trees. Reported in the N. W. and E. of the island.

The author notes that, besides these 6 indigenous Arums, *Colocasia antiquorum*, cultivated for its tubers and called "Sonjo" and "Ananesaonjo" by the natives, has been introduced into Madagascar as it has been in most tropical countries.

874 - **Cultivation of the Sago Palm and Production of Sago in the Dutch Indies.** — *Indien Uitvoer*, Year IV, No. 27, p. 664. Amsterdam, July, 1919.

The sago palm in the Dutch Indies is cultivated only by the natives. It is found notably in the Moluccas and in New Guinea, in Borneo, Sumatra and specially in the islands of Rion-Linga. It becomes mature in about 8 to 12 years according to the soil; the tree is then felled and starch is extracted from the pith by methods which are still primitive. Sago so obtained is eaten by the natives and in many places it is their chief food.

A superior quality is obtained by washing and drying the crude sago; the factories which make this product are all in the hands of Chinese and Chinese labour is exclusively employed.

At the present time much pearl sago ("paarlsago") is prepared; it is manufactured by submitting the wet starch to rapid jerky motion until it assumes a granular form; the granules are next heated and a little coconut oil is added; the granules when quite set are finally dried in the sun. True sago can be distinguished from sago made with potato starch by the fact that the former contains small quantities of albumen and fats which give it a higher food value.

The export of sago from the Dutch Indies varies from 15000 to 30000 tons; crude sago is exported to Singapore and ordinary sago to Holland (500 tons in 1917), the United Kingdom (521 tons in 1914) and the United States (429 tons in 1916).

875 - **The Jak (*Artocarpus integrifolia*) in Ceylon.** — MOLEGODE, W., in *The Tropical Agriculturist*, Vol. I, II, No. 3, p. 126., Peradeniya, Ceylon, March, 1919.

Jak (*Artocarpus integrifolia*) (1) is found in abundance everywhere in the island of Ceylon. The tree under favourable conditions is a heavy bearer and sometimes the fruits are of great size and very heavy. Fruits weighing 50 to 60 lbs. containing 10 to 15 lbs. of edible matter each are common. The writer once exhibited at the Nuwara Eliya Show a jak-fruit weighing 108 lb. In the villages, a single fruit often serves as a good meal to a family of 3-4 persons. The unripe fruit is one of the chief vegetables eaten by the population during the jak season, and frequently takes the place of rice in the poorer homes. From the formation of the fruit until it is ripe, it passes through different stages which are known up-country as "polos", "hetikos", "dandukos", "pehechchakos", and "vela" or "waraka"; it is used in a variety of ways according to its ripeness, but the ripe fruit can only be appreciated properly when just ripe, as when over-ripe it has a disagreeable smell and soon loses its flavour. There are two forms of the ripe jak — the "vela" and the "waraka"; the former has a very soft pulp and is less liked than the latter of which the pulp is firm without being hard. From the stage of "polos" till it is nearly ripe, the fruit can be used as a vegetable.

In the up-country, from March to July, thousands of fruits are allowed to waste; many of these could be preserved for future use.

The pulp and seeds of the fruit are prepared for food in various ways

(1) A species nearly related to the "bread fruit" tree (*Artocarpus incisa*) of which the fruits are used for making bread. (Ed.)

The seed contains a large percentage of starch, and it is easily preserved. Seeds of the ripe fruits are collected and dried in the sun after which they are mixed with sand and stored in a dry place. In this condition, they can be kept for 6 to 10 months. To preserve the pulp, a little more attention is necessary: it should be boiled a little (not too much), and then dried over the fire, or in strong sunlight, then packed in boxes, and kept in a dry place. The ripe pulp of the "waraka" can also be preserved in syrup.

Almost at the outbreak of the war an attempt was made to induce the natives to grow more jak. The cultivation of this tree is much to be recommended, for it comes into bearing, under good conditions, in four years.

FORAGE
CROPS,
MEADOWS
D PASTURES

876 - **Harding Grass (*Phalaris stenoptera*), a New Grass for California, U. S. A.**—KENNEDY, B. P., in *University of California Publications in Agricultural Science*, Vol. III, No. 1, pp 1-24. plates 1-8, Berkeley, California, 1917.

In California, most of the grasses of which the seed is now procurable on the market, cannot establish themselves and produce a strong sod on land not susceptible of irrigation. When sown on unirrigated land, these grasses furnish no pasturage for stock soon after the rains cease. Therefore a perennial graminea that will withstand the winter temperature, as well as the long dry season in the great central valleys, would be of great value to the live-stock industry. Such a grass, as is shown by the investigations and experiments of the writer, is the one described by EDUARD HACKEL in FIEDDE, *Repertorium nvarum specierum Regni Vegetabilis*, Vol. 5, p. 339, 1908, under the name *Phalaris stenoptera* Hack., nov. spec.

The specimens of seeds and plants from which HACKEL drew up the original description of *Ph. stenoptera*, were sent him from Melbourne, Australia. The grass was introduced into Australia by HARING (who planted it in the botanic gardens of Toowoomba, Queensland) and bears the wrong name of *Ph. commutata*, the plant with which it was grown. The seed that is procurable on the market in New Zealand and Australia is thus necessarily a mixture of the seed of the annual species (*P. commutata*), and that of the perennial species which is the true *Ph. stenoptera*.

It should be noted, that the latter had never attracted attention in South Europe, although it came originally from Italy. In South Africa, the seed was sold under the names of perennial canary grass, or Toowoomba grass, and erroneously styled *Ph. bulbosa*. The writer proposes calling it Harding Grass.

On comparing HACKEL's botanical description of the grass with specimens that he had himself cultivated, the writer came to the conclusion that the new species might be a hybrid; his suspicion was strengthened by the fact that it was completely unknown in its native land. Harding grass can be sown in the winter season, so as to take advantage of the rains. The young plants, though almost as thin as threads, are very hardy and are not harmed by severe frosts. The grass grows rapidly, stooling profusely, and and producing large clumps the first season. It forms a dense growth, making a luscious feed as the leafage is devoid of hairy coverings. The first year, the grass attains the height of about 2 ft. to 2 ½ feet, and few flower-

ing culms are sent up ; the second year the plants in seed reach a height of over 5 ft. while the ordinary growth is about 3 ft. high. The roots are fibrous, radiating downwards to a depth of 1 or 2 ft. During a hot summer, at Davis Cal., this grass was still green, when all the other forage gramineae were dried up. Horses and cattle eat Harding grass with avidity.

877 - "Wimmera" Rye Grass (*Lolium subulatum*), a Future Forage Plant from Victoria, Australia. — MULLET, H. A., in *Journal of the Department of Agriculture of Victoria*, Vol. XVIII, Part 5, pp. 266-278, 6 figs Melbourne, May, 1919.

Lolium subulatum, although a new grass in Victoria, has proved to be an excellent forage plant. It is stated to be a native of Southern Europe, and is apparently not recorded as of any economic importance there, so it is possible that Victorian conditions suit it better than its original habitat.

The earliest record of this grass in Victoria dates back 32 years. It had been planted on a farm at Noradjuha by the previous occupier, who had brought it from Europe. It is now largely grown in the wheat-growing and sheep rearing districts of Wimmera and Malee. On some of the farms, this rye-grass has reseeded itself during a period of over 24 years.

The value of *L. subulatum* as a forage plant is already well-established. It is hardy, doing well on all soils, and will even overrun salt patches, the root system is fibrous and extremely vigorous, but is not persistent; propagation is by seed only, the seeds retaining their vitality for several years in the soil. Its growth in spring is remarkably vigorous ; in an average year (rainfall 16 in.) the grass is stated to grow about 2 ft. high; on a 4-inch rainfall, it attained a height of 20-24 inches. A characteristic property of *Lolium subulatum* is to hold its seed firmly, which makes the grass very nutritious. The seeds can be easily harvested by means of a "stripper", and the dried grass makes hay of excellent quality, which is palatable and readily eaten by sheep, horses and cows ; it quickly increases the milk yield of the latter. *L. subulatum* makes good silage, and doubles the carrying-capacity of the pastures, as is shown by numerous cases mentioned by the writer. On one property 500 ewes and 300 lambs were placed for 6 months on a paddock of 280 acres without exhausting the feed.

Once sown, this plant does not require re seeding, even though the ground be broken up for cereal crops. An occasional scarifying maintains it in full productivity. The period of growth of the grass is similar to that of the cereals. Growth starts from the first autumnal rains, and in Victoria, the plant may be fed green from April to December, while dry feed is available throughout the rest of the year. *Lolium subulatum* flowers about the middle of October (southern hemisphere), and if hay is required, the grass must be cut just after the flowering stage, otherwise it becomes hard and coarse. It pollinates very freely. The average yield of clean dressed seed is about 12 bushels to the acre. If this grass can be controlled and its propagation regulated, it may prove a valuable addition to the flora of Victoria, but if it were allowed to get the upper hand, it would develop into a serious pest, owing to its easy diffusion and its vitality. Special experiments will

be carried out to determine its exact capabilities. In the meantime, most farmers state that it is easy to prevent this plant spreading to a dangerous extent. One of them advises the following method for transforming a meadow of *Lolium subulatum* into a field of wheat:— feed the grass well off with sheep; fire the stubble if there is sufficient of it; then lightly cultivate. This will bury the remaining seed and cause it to germinate after rain. Then work the fallow well while the grass is still short.

878 - **The Purple Vetch (*Vicia atropurpurea*) as a Green Manure and as a Forage Crop in the United States.**— MACKEE, R., in *Farmers' Bulletin* 967, U. S. Department of Agriculture, 12 pp., 8 figs. Washington, June, 1913.

Vicia atropurpurea, or the purple vetch, is an annual; it was brought into the United States from Naples by the Office of Foreign Seed and Plant Introduction in 1899, and all the introductions since then have been of the same variety. The crop has been tested most extensively in the Pacific Coast States, where it has given very favourable results. In California, it has proved one of the best crops, if not the best crop for green manure. In West Oregon, and West Washington, it can be grown with success for seed, and at the present time there is a limited acreage under purple vetch. It requires similar conditions to those needed by the common vetch (*Vicia sativa*) and the hairy vetch (*V. villosa*), but is a little less resistant to cold. Under average conditions, however, the purple vetch will stand a temperature of about — 9° C.; where the temperature does not fall below this, it can be sown in the autumn; where the cold is greater, it is advisable to sow in spring. It is well to inoculate the soil when this crop is sown for the first time. The average seed yield is 10 to 12 bushels per acre. When grown off green-manuring, seed or hay purposes, purple vetch should be seeded at the rate of 60 to 80 lbs per acre. It is very nourishing and affords good pasturage for all kinds of stock, as well as making excellent hay.

The only insect that has attacked *V. atropurpurea* in the United States is an aphid which does serious damage to the field pea and common vetch.

879 - **"Kudzu vine" (*Pueraria hirsuta*), a Leguminous Fodder Plant in Cuba.**— CALVINO, M., *Revista de Agricultura, Comercio y Trabajo*, Year II, No 5 pp. 196-199, 4 fig. Havana, May, 1919.

Pueraria hirsuta Schneider (synonyms, *P. Thunbergiana* Benth; *Pachyrhizus Thunbergianus* Sieb. and Zucc., *Dolichos japonicus* Hort), a climbing leguminous plant, native of China and Japan, has been suggested as a perfect fodder for the warm southern parts of the United States. In Florida it has been reported as the only plant which can take the place of the "velvet bean" (*Stizolobium* spp.) for fodder and green manure.

The author has experimented with it since 1913 in the high central plateau of Mexico, where the aerial parts of the plant dry up in winter, but the fleshy roots in spring throw up vigorous shoots which develop into fine stems covered with much foliage, the leaves attaining a length of 12 to 18 mm. For harvesting it is sufficient to let it dry in the sun for 24 to 48 hours.

The plant is propagated by seed or by root cuttings.

At the Cuba Agronomic Station, *Pueraria hirsuta* has been found to grow vigorously, so much so that it covers and smothers all other vegetation, even when arborescent (banana) and produces abundantly seed of high germinating power (100 %). Regarding the seeds and pods the following data are known — average weight of 100 seeds gr. 18.25; average number of seeds per pod, 8, (maximum 12, minimum 3); average length of pod 98 mm., average breadth 13 m; average thickness of the valves 6 mm. Hay made from this plant is very rich in albuminoids; the analysis of a sample from Florida gave — albuminoids 17.4 % and carbohydrates 30.2 % (as against 16 % and 31 % respectively for hay made of lucerne or alfalfa). It can be fed to all kinds of animals and does not upset them. Powdered and mixed with water it can be given to poultry.

In Japan, according to GEORGEKSON, a fibre, from which very fine strong material is made, is extracted from the stalks.

The thick fleshy roots are very rich in starch and edible matter. At the chemical laboratory of the Cuba agronomic station an analysis gave the following result : —

	Fresh root	Air dried root
Water	88.25 %	16.15
Mineral matter	1.31	8.60
Albuminoids	1.52	10.81
Fats	0.19	1.10
Cellulose	1.43	10.20
Carbohydrates	7.40	52.84
Caloric value { Rubner	38.39	274.21
Starch value { Atwater	35.94	256.64
	9.88	80.31

880 — **The Improvement of Poor Pastures for Sheep in New Zealand.** — See No. 955 of this Review.

881 — **Hay Caps, in the United States.** — MAC CLURE, H. B., in *Farmers' Bulletin* No. 977. U S Department of Agriculture, 16 pp., 2 figs. Washington, May, 1918

The writer describes the manner in which hay caps can be used to keep the rain from wetting hay in cocks. They afford an excellent protection for the first and last cuttings of lucerne in the corn (maize) belt, and are a valuable addition to the hay-making equipment in the South, where several crops of lucerne and of mixed hay of lucerne and Johnson grass (*Sorghum halepense*) are grown in the year.

Hay caps are of two distinct kinds, those that are entirely impervious to both air and rain, and those that shed all the rain, and at the same time allow the moisture-laden air to pass through and be carried away. Waterproof caps are of two kinds, those made of wood-pulp and those made of cloth treated so as to be waterproof (for this, paraffin oil, gelatin and chrome alum, soap and iron sulphate, etc., are employed).

Cloth waterproof caps being lighter and less cumbersome to handle than wood-pulp caps, are generally preferred to them.

A very satisfactory method of fastening a hay cap on a cock is to attach a cement ball to each corner.

Caps 30 to 36 inches square seem to be preferred.

The writer describes the various kinds of caps, their durability, and storage, and gives the reasons for their use: they keep the hay dry, and prevent its being discoloured, they also save the leaves and give a greater yield of hay of improved feeding value.

FIBRE CROPS

882 - **Cotton Varieties with Long Lint in the United States.** — PRYOR, W. L., in *U. S. Department of Agriculture, Bulletin*, 733, 8 pp. Washington, Sept. 6, 1918.

The length of the fibre is not the only factor that determines the price of cotton, but given that the strength of the fibres in both cases is equal, a cotton with long lint is preferred to one with short, because there is less waste in spinning it, and the fabric produced is more durable. Varieties of cotton with short lint are, as rule, earlier than those with long, and are less attacked by the boll-weevil (*Anthonomus grandis*), but of late years, long-staple varieties have been grown in the United States which are as early and as productive as those yielding short lint.

As there is considerable difference between the North American and the British ideas as to the length of staple, in order to prevent confusion in stapling, the millimeter standard is being largely adopted.

The States of the Union which produce the greatest amount of extra-staple cotton are, in decreasing order of production: Mississippi, Texas, Arkansas, Oklahoma, South Carolina, Louisiana.

Sea Island, Egyptian and Durango cottons with long staple are also cultivated in some parts of Georgia, Florida, South Carolina, Arizona and California.

883 - **Cotton Production in the State of São Paulo in Brazil.** — PRÉSTAMA, P. R., in *La Revista colonial*, Year X, No. 5, pp. 101-102 São-Paulo, May 31, 1919.

The cultivation of cotton in the State of São-Paulo dates from the early days of colonisation there. In 1600 enough cotton was grown from making the coarse clothes in which the colonists were clad. Its cultivation was fairly important after the American war of secession; between 1870 and 1880 the State of São-Paulo exported annually 7 to 8 thousand tons of ginned cotton. At the present time the whole crop is absorbed by the factories of the State which are always crying out for more.

The cotton-growing zone of São-Paulo lies along the Sorocabana railway; here are the most productive districts such as Tatuhy, Porto Felix, Itapetininga, Tiete, etc. The species chiefly cultivated is *Gossypium herbaceum*, with North American varieties. The cotton produced is of better quality than that grown in India, but not so good as that grown in the north of Brazil. The staple of this cotton is, on the average, 28 mm. long mm., 0.018 to mm. 0.019 in diameter and has a breaking strain of 4 to 6 gr.

Sowings are made at the commencement of the rains in September and October. The plants require 6 to 7 months (from September to April or

May) to mature all their pods. The cotton is harvested in May and June ; the yield is from 1800 to 3000 kg. unginned cotton per ha., yielding 30 to 36 % of cleaned cotton (an average of 600 to 1000 kg. per ha.)

The "Coruquerê" (*Alabama argillaceo*) often causes much damage by eating the leaves and the involucre of the capsules.

Occasionally locusts also damage the plants.

The average annual production of unginned cotton during the 7 years 1899-1900 to 1905-1906 was about 5000 tons ; it was 6285.5 tons in 1913-1914; 8699 tons in 1914-15; 16,326 t. in 1915-16; 22,494 t. in 1916-17; 36 852 t. in 1917-1918.

The yield of cotton does not suffice for the São-Paulo factories as the following figures, for ginned cotton, show . - -

Year	Production in the State of São Paulo	Imports *	Total consumption
1911	6 598 401 kg	7 611 550 kg.	14 242 951 kg.
1912	5 625 463	7 163 287	12 784 750
1913	11 945 240	6 620 814	18 566 054
1914	2 828 175	6 388 127	9 216 602
1915	3 914 596	12 732 611	16 647 140
1916	7 346 857	10 601 113	17 947 970
1917	11 122 126	11 245 740	25 366 166

*From the northern States of Brazil and, to a smaller extent, from the United States

The amount of cotton goods manufactured in 1917 was 160 200 000 m.

The crop for 1918-19 is estimated at 100 000 t. of unginned cotton in spite of damage from locusts, which have appeared in several districts, and other causes.

884 - **Cotton in Italian Somaliland.** - BRANDALISE A, in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. V, Part 1-2, pp. 66-75. Palermo 1919.

One of the qualities of the indigenous cotton plant in Italian Somaliland is its wonderful resistance to drought ; it grows in fact in a region where the maximum rainfall is not more than 300 to 500 mm. a year.

Cotton can be grown over the whole coastal zone from beyond Aluha up to Gumbo, a length of 2000 km. by a width of 20 km. At present this zone is covered by a thick thorny scrub and is scarcely used except for grazing : a few fields are scattered here and there. The cultivation of cotton must have been fairly extensive formerly but has decreased owing to competition by American cotton cloth.

The cultivation of cotton can be associated with that of food plants and others. It comprises the following operations : — burning the thorny bush and felling the trees ; fencing ; sowing at the beginning of the rains (April), 8 to 10 seeds in a hole, fertilised with muddy water of the Uebi ; thinning out, leaving 2 or three seedlings, 15 to 20 cm. high, in each hole. Picking the crop and ginning are done by hand.

From the second year each plant gives 300 to 400 cotton bolls (one from each capsule) or may even give up to 800. One boll, with seed, weighs on the average at least 2 gr. The author found them weighing 1.950 gr to 2.960 gr. averaging 2.536 gr. There may be as many as 10 000 plants per ha.; even if there are only 7000 (owing to loss by parasites) with 150 bolls per plant, the yield may be estimated at 2 100 kg. per ha. The cost is estimated for the following periods per ha.

1st year. — Clearing and fencing 40 rupees; tilling and sowing 50 rupees; several hoeings 100 rupees; picking 20 rupees; miscellaneous expenses during cultivation 40 rupees; total 250 rupees per ha..

Each of the following years (from the 2nd to the 5th). — Fencing 10 rupees; weeding 100 rupees; picking 40 rupees; total 150 rupees a year: 600 rupees for the 4 years; total for the 5 year period 850 rupees per ha.

Assuming a crop of 10 bolls per plant in the 1st year and of 150 in each of the others a weight of 2 gr. per boll, with 7000 plants per ha., there would be a yield of 140 kg. in the 1st year and a yield of 1200 kg. in each other year, or for the 5 year period 8540 kg., which at 25 rupees per quintal make 2135 rupees. This represents a gain of $2135 - 850 = 1285$ rupees, or 257 rupees (431 fr.) per hectare and per annum. In this calculation the estimate of the receipts is a safe one and that of expenses high. For the native, who does the work himself with the help of his family, the profit is much greater, and would be so for an European who planted on a large scale, making use of by-products and raising cattle.

PESTS AND DISEASES. — The chief is a species of rat, *Etherocephalus ruppellii*, which the Somalis call "Zabat ourres" and the Swahilis call "durme". These rats devour large quantities of the seed at the time of sowing; no remedy has been found, and it is not much use keeping watch. After the early rains numerous caterpillars and winged insects come out of the ground and eat the leaves of the cotton plants as well as those of vegetables, etc.; powdering with carbolised extract of tobacco (with which the author experimented) was successful.

Another pest of the cotton plant is *Dysdercus scassellatii* (1). The cotton worm is also very common.

After 7 years residence in the colony the author observed for the first time the "*cancro del colletto*", or canker of the crown of the root (*Mocosmopora vasinfecta*), which he thinks was introduced in the Genale plantation in 1917 with plants or seed then imported. At the beginning of 1918 the disease had spread over 150 km. and had reached Balad.

885 — Cotton in China and Korea. — *Bulletin économique de l'Indochine*, Year XXII, New series, pp. 105-106. Hanoi-Haiphong, Jan-Feb., 1919.

I. CHINA. — China at the present time stands third among cotton producing countries, the United States and the Indian Empire ranking higher. The total annual production is, however, not exactly known, as the greater

(1) See *R.* July 1918, No 730 (*Ed.*)

part of the raw material is manufactured by the growers; it is estimated at 2 000 000 bales of 4 *piculs* each (1 *picul* = 60.453 kg.), or about 483 600 tons. The fibre produced is of a coarse kind and will not give thread finer than 20; it is generally used locally. About 70 % of the export, valued in 1916 at 17 000 000 Haikwan *taels*, goes to Japan (the Haikwan *tael* = 1.114 Shanghai *taels*; in 1913 it was worth on an average 3.81 fr). It would doubtless be possible to improve the quality of Chinese cotton by more scientific methods of cultivation than those in use at present, which consist in growing the plant on the same land along with wheat and other plants; but for spinning very fine thread American cotton would always have to be imported. In 1911, a society was formed against fraud by limiting the watering of the cotton with the object of increasing the weight; members undertook neither to export nor to use cotton containing more than 15 % of moisture.

Experiments for improving cotton have shown that, at least for the Shanghai district, American seed is not suitable, owing to excessive humidity and want of heat which prevents the plant from maturing; Egyptian and South Sea seed were even less successful.

Experiment has shown that the Chinese sow cotton 3 or 4 weeks too late. They are led to do so by fear of injuring the wheat with which the cotton is interplanted. The loss in yield, if only cotton is grown, is too great to be faced. It has been shown that by sowing only sound selected seed and hoeing, which at present is never done, the yield rapidly increases threefold. In the province of Chansi, which produce the best Chinese cotton, American seed, recently introduced by missionaries, is used. The climate of that district is more suitable; but, at the end of 3 years, the cotton became identical with that grown from local seed.

The Government has engaged an American expert to study the question. He is of opinion that the reason why American plants have failed to mature is an excess of humidity and the manure used; the Chinese use a manure which contains too much nitrates and not enough phosphates; the plant grows too quickly and fails to mature (these remarks have reference specially to the district of Peking and the North).

Since 1895, the number of mills has rapidly increased; there are at present 40 factories with 1 266 848 spindles and 6597 looms: 6 British with 298 076 spindles and 2221 looms, 3 Japanese with 211 464 spindles and 876 looms. The remainder are Chinese. The largest works are grouped round Shanghai and are prosperous. A serious obstacle to the development of the industry is found in the customs and octroi duties which are too high compared, for example, with Japanese customs.

II. KOREA. — The position of cotton cultivation in Korea appears to be most favourable. The area at present under cotton is about 99 000 ha. and it is estimated that it will soon be doubled.

The 3 cotton companies of South Korea, province of South Zeura, are about to amalgamate.

Experiments in west Korea have resulted in a cotton with long, strong, smooth, pure white fibre.

886 — **Cotton in Queensland, Australia.** — *Queensland Agricultural Journal*, Vol. XI, p. 58, Brisbane, Feb. 1919.

Since the Department of Agriculture, in order to stimulate the production of cotton in Queensland, undertook to supply seed gratis to farmers, established a departmental cotton ginnery in Brisbane, and further encouraged the cultivation of cotton in other ways, a number of small areas were planted in various southern districts. In 1914, 9445 lb. of raw cotton was received at the Departmental Ginnery, of which 524 lb. was sent to Panama; the balance, 8921 lb., yielded 2794 lb of lint (ginned cotton) which was sold locally. In 1915-16, 29230 lb. of raw cotton was received, which yielded 100-6lb. of lint. In 1916-17, 118229 lb. of raw cotton was received, which yielded 37694 lb. of lint. In 1917-18, 166 458 lb. was received, which yielded 54280 lb. of lint.

887 — **Production of Gomuti Palm Fibre in the Dutch Indies.** — *Handelsberichten*, Year XII, No 609, pp 458, 1 Table, The Hague, November 14, 1918.

Gomuti palm fibre is obtained by stripping of the fibrous sheaths of the leaves of *Arenga saccharifera* Labill. The natives of the Dutch Indies use these fibres for roofing their houses, for cordage and brushes, and call them "gemoetol". In Europe there is now a demand for the fibre of the Gomuti palm on account of its notable resistance to water; however the breaking strain of this fibre is not half that of hemp, nor does it appear to be utilisable in the paper industry. From tests made by the Government of the Dutch Indies it appears that this fibre is a very suitable material for covering submarine telegraph cables owing to its resistance to the action of water; for cordage the fibre is too coarse and too wanting in elasticity to be successfully used, but it is very well adapted for the chief use made of it by the native, that is to say for making brushes.

The Gomuti palm is found wild in the whole Malay archipelago. There is no difficulty in obtaining large quantities of the fibre, especially as the natives also cultivate the palm in plantations for palm wine, palm sugar and sapo. The manufacture of the fibre for export is very simple and consists in cleaning, sorting and packing; an increasing export may therefore be predicted.

From 1913 to 1916, the figures for the export of Gomuti palm fibre from Java and Madoera in kg. for Holland and total exports respectively were: — 1913: 39896 and 116100; 1914: 49464 and 99834; 1915: 12000 and 52017; 1916: 54359 and 84313.

The exports, which in 1913 and 1914 were chiefly to the United Kingdom and Belgium, were directed to Australia owing to the war.

888 — **Various Reports on the Production of Fats in Different Countries.** — *Institut Colonial de Marseille, Bulletin des Matieres Grasses*, No. 1, pp 39, Paris 1919.

The first *Bulletin* of the Fats Section of the Institut Colonial of Marseilles contains the following reports: —

A. — **GROUNDNUT AND OIL PALM IN WEST AFRICA** (extract from a note by the Governor General, M. ANGOUVANT, on the production of oil seeds and vegetable fats). This report deals with —

(1) *Groundnuts*. — Up to a recent date this crop has been confined to Senegal, Haut Senegal-Niger, and French Guinea have hardly commenced to export. Comparing the figures it is noticeable that the quantity of groundnuts exported fluctuates considerably from year to year. On the whole progress is slow. Also, it has been noticed that the quality of the nut tended to decrease, for the oil content diminished little by little and consequently also the relative value of the nuts in European markets compared with those from other countries. The author suggests immediate steps to remedy the state of affairs arising from this crisis of quantity and quality.

There are two ways of increasing production; an increase in the area under groundnuts and an increased yield (selection and improvement of cultural methods).

The author discusses these subjects at length.

(2) *Palm oil and palm kernels*. — The problem of increasing the contribution of French West Africa to the palm oil industry is more complicated than in the case of groundnuts, for before the war foreign buyers (chiefly English and German) bought everything; during the war requisition was possible, but the problem is what is to be done now the war is ended.

This is the problem which the author endeavours to solve by suggesting certain measures.

He deals, from the point of view of increasing production, successively with: — (a) Palm groves and natural or artificial stands (extension, improvement; labour; study of varieties of palms and methods of cultivation; diseases; schools and professional instruction).

(b) Mechanical collection of the fruit; mechanical extraction of oil and crushing of the husk by machinery; routes and methods of transport.

The author supplements his report on groundnuts and the oil palm with the following sections: —

(3) *Castor oil, sesame and similar products*; (4) *Copra*; (5) *Programme of production, Agricultural Service, Schools, Institute of Bingerville* (1).

B. GROUNDNUTS IN BRITISH INDIA. — (Extract from the *Report of the Agricultural and Trade Conference*, Madras, Dec., 1919).

C — THE GROUNDNUT IN JAVA (from an article published by M. WIJS in the review *Oost Indische Cultuuren*).

In the Dutch Indies 3 varieties of groundnut are chiefly cultivated:

(1) The old Java variety with 2 or 3 seeds (sometimes 4); the duration of growth is from 6 to 7 months.

(2) Another indigenous variety with 1 seed, ripening in 3 or 4 months, less interesting but not particular as to soil and requiring but little cultivation; grows even in compact clay soil.

(3) The Holle variety generally has 2 seeds, sometimes 3, rarely 4; duration of growth 3 months; easily pulled up.

The first variety is the most productive; the third is to be recommended, especially on account of its rapid growth.

Generally the groundnut requires much water and heat, especially

in the second period of growth. In Java they form part of a three year rotation in which the first crop is rice or, preferably, sugarcane. For some years groundnuts have been successfully sown twice a year in dry ground of little value.

In Java it is considered that groundnuts require good soil preparation ; 2 or 3 diggings followed by harrowings, proper drainage must also be provided.

The author deals successively with cultivation, pests, harvesting, yield, price, sale, oil content, extraction of oil, uses and commerce.

D. — **FAT INDUSTRY IN JAPAN** (translation of a report by M. W. J. DAVIES, British Consul in Japan published in *The Board of Trade Journal*, Dec. 26, 1917). The author deals successively with : general remarks on the fat industry in Japan ; state of factories, methods of extracting oils ; linseed oil, soya oil, colza oil, cotton seed oil, coconut oil, other vegetable oils ; vegetable wax ; fish oil ; whale oil ; glycerin from fish oil ; tallows.

F. — **THE FAT INDUSTRY IN RUSSIA** (extract from the Bulletin of the Russian Chamber of Commerce in Paris, published in February, 1918) (1).

F. — **THE OLIVE CROP IN SPAIN.**

G. — **PALM OIL AND PALM KERNELS** (information regarding the yield in British West Africa and Togoland).

H. — **THE COCONUT PALM** (export of products of the coconut palm of Ceylon).

I. — **THE CASTOR OIL PLANT IN THE UNITED STATES.**

889 — **Attempted Improvement of an Olive Garden in the Province of Lucca, Italy.**—

ZANONI, F., in *Giornale di Agricoltura*, Year LVI, No. 7, pp. 205-207. Piacenza, July, 1919.

The author states the results obtained in a large experimental olive garden (36 ha.) of Campo Romano (commune of Stiava, province of Lucca), on hilly ground. Up to 1913 this olive garden had been treated in the traditional Ligurian and Tuscan manner, that is to say it was manured, but little or no pruning was done. Under this treatment, and badly manured, the trees produced a good crop only in favourable years.

Prof. BRACCI (Director of the Spoleto experimental oil factory) planned works of improvement in the olive plantation of Campo Romano, dividing them into two groups corresponding to two periods : — (1) for shaping the trees ; (2) for establishing the reconstituted cultivation.

The shaping of the trees was effected by thinning and topping, not at an equal height but at a height proportional to the growth of each tree. The tops of 7000 olive trees yielded wood which was sold for 15000 lire ; consequently, owing to the present high price of fuel, the cost of the work was more than met by the sale of the wood.

The work of consolidation consisted in : — Manuring, the first year, with phosphorus, nitrogenous and potassic fertilisers, at a short distance round the foot of the olive trees, rather a light dressing as few shoots were produced that year after the shaping of the trees ; green manuring with beans in the second year ; Dunging in the third year.

(1) See No. 991 of this *Review*. (Ed.)

In the second year pruning was done and the crown brought into proper shape.

The thinning diminished the damage caused by pests — “occhio di pavone” (*Cycloconium oleaginum*), *Phloeothrips oleae*, olive fly (*Dacus oleae*) — and made it easier to fight them.

The utility of the work suggested by Prof. BRACCI was at once proved by a more abundant crop of fine olives compared with the previous crops from this olive plantation and the crops in neighbouring olive plantations.

890 - Possible Development of the Cultivation of the Oil Palm in the Federated Malay States in the Peninsula of Malacca. — EATON, B. J. and SPRING, G. G., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. II, pp 493-512. Kuala Lumpur, Sept-Oct., 1918

Owing to the growing interest taken in the African oil palm (*Elaeis guineensis*) the Department of Agriculture, Federated Malay States, has received many enquiries as to the possibilities of growing this palm on a commercial basis in that country. Many capitalists would desire to establish plantations in the territories of the British protectorate in the peninsula of Malacca, and the chief reason for their hesitation is want of information about the oil palm. The object of the present article is to supply the desired information on the subject. The oil palm is indigenous in West Africa, but it is abundant all over tropical Africa and grows luxuriantly in all tropical countries. It is found as an ornamental plant throughout the Malay peninsula. It has been cultivated in the Botanical Garden at Singapore, and, since 1895, in the Garden at Kuala Lumpur. The authors were informed that it has been planted on a large area (3642 ha.) in Sumatra. There is every reason to think that the oil palm will thrive on most soils in the territory of Malacca which are capable of holding a fair amount of moisture, but rich moist soils would probably give the best yield. On an area of some acres, near the buildings of the Department of Agriculture, oil palms have been grown on poor light land and it is curious to see how well they have done. It is probable that soils suitable for coconut palms would generally suit *Elaeis*, but remarkably fine specimens have been grown on gently undulating ground which is unquestionably to be preferred from an economic point of view. It is known, indeed, that the expense of drainage of coconut land is considerable, while gently undulating ground costs little or nothing to drain, and given equal results is to be preferred.

The authors give all necessary instructions to planters regarding the preparation of nurseries and germination of seed, final planting, cultivation and care of the oil palm.

Seeds of 3 varieties were received from the Department of Agriculture, Nigeria: — “*Microsperma*”, thin shelled; “oke pankaro”, hard shelled; and “king of the fetish” (“ope ifa of Ibadan”). In West Africa thin shelled varieties are preferred because the palm nuts are generally cracked by hand. It is desirable not only to obtain varieties with thin-shelled nuts which are easily cracked but also those which yield plenty of fruit and the best quality of oil.

The authors deal successively with the cost of establishing a plantation

of oil palms in the Federated Malay States where there are great possibilities for such cultivation ; palm oil and palm kernel oil (analyses, price, trade, uses, etc) ; implements and machinery.

891 - **Note on Coconut Cultivation in the Province of Madras, India.** — MAC RAE, W., and ANSTAD, R. D., in *Year Book of the Madras Agricultural Department*, 1918, pp. 121-131. Madras, 1918.

Experiments in the culture, selection and manuring of coconut palms carried out for several years at Alleppey (province of Madras) by Mr. G. G. H. DAVEY. Conditions in this district are favourable for the cultivation of coconut palms owing to heavy and well distributed rainfall, to the richness of the soil on the banks of back waters, consisting of thick black mud, which is brought and heaped in mounds along the canals and on the bunds of the paddy fields on which the coconut palms are planted ; along the sea shore the soil is greyish sand which, in spite of its barren appearance, produces healthy groves. In a plantation purchased by M. DAVEY in 1909, the 134 palms which grew there yielded 3188 nuts in 1910. The yield constantly increased under the experimental treatment in which noxious undergrowth was cut out, Bamber's mixture and similar applications were applied in 1914 and 1916 (in 1915 the palms were only manured with coconut cake) ; in 1914 the number of palms was reduced to 111 and the yield that year was 4763 nuts, the yield in 1915 was 4675 nuts and in 1916 it was 7356 nuts.

M. DAVEY made interesting experiments on 4 acres of apparently unfertile land which he bought in 1906 for the moderate sum of 350 rupees, and which bore 49 coconut palms. Many of these palms had never borne fruit and their stems showed clearly the bad condition they were in. Mr. DAVEY first experimented with local manures. The crops were as follows :— 516 nuts in 1907 ; 861 in 1908 ; 1598 in 1909 ; 1424 in 1910 ; 1845 in 1911. Mr. DAVEY then sent a sample of the soil to Mr. KELWAY BAMBER who recommended the application of a mixture of the following composition :— groundnut cake 150 lb. ; fish manure 300 lb. ; dried blood 100 lb. ; superphosphate 100 lb. ; bone meal 100 lb. ; kainit 200 lb. ; sulphate of potash 50 lb. ; total 1000 lb. ; 15 lb. of this mixture to be applied annually to each palm.

Mr. DAVEY carefully followed this advice ; only the mixture had to be slightly modified as some ingredients were unobtainable. The crops obtained have been as follows :— 943 nuts in 1912 ; 2083 in 1913 ; 2208 in 1914 ; 1614 in 1915 ; 4810 in 1916. The palms are now perfectly healthy.

It may be noted that the crop was less in the year following the first application of the mixture and increased after. This seems usual and agrees with observations made at the Porto Rico Agricultural Experiment Station.

Another result of manuring is the increased copra contents of the nuts. Before the application of manure the number of nuts required to make a *candy* (1) of copra was from 2300 to 2400, whereas now 1950 to 2050 nuts suffice.

(1) 1 *candy* = 660 lb = 299.369 kg (*Fd*)

The yield of nuts in the neighbourhood of Alleppey appears to be big, frequently reaching 80 to 100 nuts per tree where fertilisers are used. The authors had heard of a plantation 18 miles north which gave extremely high yields, some of the palms giving 400 and even 450 nuts a year. This phenomenal yield is worth verification and investigation. The authors do not know what the average yield on the west coast may be but in other countries it only reaches 60 to 80 nuts yearly. Thus, in their book, *A practical Guide to Coconut Planting*, MAURO and BROWN say "from large well cultured trees in full bearing all over the Peninsula (F. M. S) we consider an average of sixty nuts a tree per annum the actual limit; nothing approaching this result, however, need be reckoned on without high cultivation".

It is a common mistake to overcrowd the palms; they grow better and the yield per tree and per acre is greater if they are not grown too close (1).

At Alleppey frequent application of lime improves the growth and yield. Any other manure is scarcely necessary as the trees are grown in rich black alluvial soil dredged from the bottom of lakes and brought a considerable distance at large expense. It is usual, however, to give the trees a few baskets of river sand every second year; this treatment is said to help their growth. Cultivation, especially in circles round the trees, is generally practised, but, as far as the authors could judge, the use of green manuring was neglected. It might be difficult to cultivate green leguminous crops on sandy soil, but it ought to be possible to do so, as several leguminous weeds were noticed growing spontaneously, one being a species of *Alysicarpus* or a plant like it. Probably *Crotalaria striata* or *Tephrosia candida* could be established, especially where manuring is done. On the rich back water lands this kind of manuring is not required, for there is usually a heavy crop of weeds which are periodically buried.

DISEASES AND PESTS. — In this district, and specially near the town, the coconut palms are subject to many diseases and properly organised remedial measures would lead to appreciable gain for the cultivators. The chief diseases are: —

(1) A root disease which produces a gradual weakening of the tree indicated by a diminishing yield and by smaller leaves with a yellowish sickly appearance, and finally by the death of the tree. A *Merulius* was found at the base of one tree.

(2) A leaf disease which gives the leaves a very characteristic appearance; the pinnae of the leaf are destroyed before they unfold so that the expanded leaf has a rat-tailed appearance at its extremity.

(3) A leaf disease caused by *Pestalozzia palmarum* which produces grey or brown decayed spots on the surface of the leaf. This detracts from the value of the leaves as they are useless for making "cadjans".

Among insect pests the following may be noted: — *Oryctes rhinoceros*, *Rhynchophora ferruginea* and a scale insect which attacks the nuts and

(1) With reference to the spacing of coconut palms in plantations see R, Febr. 1919, No. 201, pp 180-181 (Fd).

which is found in black masses on the outside of the husk ; this scale insect is also found on areca nuts, but probably it does little harm.

892 - **The Coconut Palm in the Philippines ; Production.** - COOKSON, W. S., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 11, pp. 317-320, Kuala Lumpur, Sept-Oct., 1918.

The total number of coconut palms in the Philippines, according to the census of 1918, is about 31 000 000, and the crop for the fiscal year 1917-1918 was about 892 000 000 nuts, or about 29 nuts per tree.

The annual yield per tree is very variable. The highest yield is reported in the Zamboanga district, where it is 45 nuts ; at Cebu it is 22 ; in 5 other districts it is 19 $\frac{1}{2}$, 19, 13.9 and 8 nuts respectively ; in two other districts the yield is only 6 nuts per tree.

Most of the planted areas are in Luzon, the remainder being chiefly in Mindanao, Cebu and Leyte. The oil mills are all at Manila except one at Cebu and one recently erected at San Pablo. These mills do not own plantations but buy their copra.

In 1899, the Philippines produced 14 000 tons of copra ; in 1912 the production was 169 000 tons. Before 1912 no oil had been manufactured except a small quantity produced by primitive methods. About 50 000 000 nuts were treated in 1914 and produced 4600 tons of oil, of which 1300 tons were exported. In 1912 and 1913, modern mills were erected and the production of coconut oil reached 16 000 tons in 1916 and 49 800 tons in 1917. In 1916, 72 000 tons of copra were exported. Since 1917, the export is indicated by value, not in tons ; the export of copra was valued at \$1388 418 in the fiscal year ending in June, 1917, and \$1 905 448 in the fiscal year ending in June, 1918. Previous to 1915, coconut oil was produced in very few factories and there were very few mills with modern machinery. Now, at Manila alone, there are 12 mills and the machinery is modern ; the value of coconut oil exported during the first three months of 1918 was \$1610 000. The mills are making large profits and new mills are being erected.

The export of copra and oil is chiefly to San Francisco.

RUBBER,
GUM AND RESIN
PLANTS

893 - **The Increase in Girth of Hevea Trees.** - KEUCHENIUS, P. E. (Mededeelingen van het Besidekisch Proefstation, Rubber Serie No. 5), in *Archief voor de Rubbercultuur in Nederlandsch Indië*, Year II, No. 7, pp. 407-432, fig. 7 Batavia, 1918.

An investigation on the increase in girth of Hevea trees. The particulars for these investigations have been obtained from periodical measuring of the girth at a level of 1 m. or 3 ft. above the ground and from periodical registration of the rainfall. After studying all the particulars of the investigations, the writer has come to the following conclusions:—

1. The growth of Hevea during the whole year is not constantly the same.

2. Each year Hevea passes through a period of absolute standstill in growth and this period may last for a longer or shorter time.

3. Rainfall has no influence on the periodicity ; the rainfall during one quarter has no influence on the growth during the same or the follow-

ing quarter; *i. e.* early setting in of drought or sudden rainfall do not interfere with the periodical standstill in growth. No indications are to be found that a pronounced East monsoon during one quarter should have an unfavourable influence on the growth, nor that a more regularly distributed rainfall during the quarter of minimum growth (which is also the East monsoon) should have a favourable effect on the growth.

4. The growth depends wholly on the total yearly rainfall: too much or too little rainfall can have an unfavourable influence on the growth.

5. Robusta coffee as catch crop retards the growth of Hevea; the influence of this catch crop, however, is very small and may account for the fact that rubber grows quicker in West than in East Java.

6. On good soil and with Robusta interplanted as a catch crop an increase in girth of 8 cm. per year may be expected in the Besoeki district at an altitude of 1800 ft, which means a rate of growth at which the trees become tappable after 5 years (taking a girth of 18 in 3 ft. above the ground as basis). At an altitude of 2800 ft. however Hevea is only tappable after 8 years.

894 - Notes and Experiments on the Coagulation of Hevea Latex. - VERNET, G., in *Annales du Muséum colonial de Marseille*, Year XXVII, 3rd Series, Vol. VII, Part I, pp. 137-167 Paris-Marseille, 1919

The author (chemist at the Pasteur Institute of Nha-Trang) has divided his paper into 3 parts -- he first explains critically the general theory of coagulation, next he examines how coagulation takes place by drying centrifugalisation; lastly, he investigates spontaneous coagulation, reviewing some of the processes which are capable of controlling it.

The author formulates the following conclusions on the subject of natural coagulation of latex which are interesting practically. — A good natural coagulation can be obtained:

(1) By adding, when necessary, sugar to the extent of its deficiency in the latex, say 1 gm. to 10 gm. per litre on an average.

(2) By causing coagulation to take place without contact with air, by means of a float or some other method

(3) By the action of micro-organisms at a temperature between 30° and 45° C., that is to say, by first heating the latex with the help of a regulator and then the room itself

(4) If that does not act, a little serum from the previous day's coagulation should be added, or better still some selected ferment.

(5) It is to be noted that, even when diluted with several times its volume of water, Hevea latex coagulated competely in these conditions; it is well, however, in that case to increase slightly the amount of sugar.

Regarding the action of micro-organisms on the coagulated albuminoids, the isolations made by Dr DENIER have shown that 12 species digested white of egg and 11 liquefied gelatin. The same micro-organisms can act both as generators of coagulating acids and as transformers of colloids.

The author's process of isolation of albuminoids in the latex are too

recent to enable him as yet to investigate the action of the micro-organisms on their chemical composition.

Elsewhere Messrs GRANTHAM and EATON have shown that, under the influence of micro-organisms, albuminoids in the latex are transformed into amino acid which act in hastening vulcanisation, as well as on the physical characters of the vulcanised rubber.

It is, therefore, a question whether by a more perfect method of coagulation by heat than that which the author made use of and by subsequent addition of sterile coagulum, the maximum yield and a better quality of rubber could be obtained.

For coagulation, the method which has given the best yield is with latex, made very slightly acetic, in an autoclave at 120°C.

The autoclave by itself only gives good results if the latex is pure, and whenever the latex is dilute, as often happens in the rainy season, the results are bad. However, if the latex is made very slightly acetic it coagulates marvellously in the autoclave even when diluted with several times its volume of water. Once a perfectly sterile coagulum is obtained it will be easy to use it. With this object, the microbes which are found locally can be isolated and studied, or others can be procured from countries where the best rubber comes from, such as the upper Amazon.

Whatever may have been the earlier opinion on this subject it is now recognised that Brazil rubber is by no means sterile. The temperature to which the "seringueros" submit the coalescent latex (then slightly acid) in the afternoon is in fact of too short duration and is not sufficiently high to sterilise it in such a highly polluted environment. The author notes the similarity which exists in these methods of preparation and enquires whether the long sought secret of the special quality of Brazil rubber does not lie there. He hopes that experiments will soon give the answer.

895 - **Bacterial Changes in Hevea Latex.**—STAFFORD WHITBY, G., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 11, pp. 513-516. Kuala Lumpur, Sept-Oct., 1918.

The object of the present note is to indicate the relation existing between spontaneous changes in Hevea latex and changes due to bacteria.

The conclusions reached after an extensive series of quantitative researches into bacterial metabolism made by A. J. KENDALL and his collaborators working under his control may be summed up as follows:—

The fundamental principle of bacterial metabolism is contained in the following law:—Fermentation takes precedence of putrefaction. That is to say, bacteria can generally use either carbohydrate or protein, and act upon the former in preference to the latter when both are present in the same medium. Bacteria act on carbohydrate by fermentation and on nitrogenous substance by putrefaction.

When, by their vegetative activity, bacteria use (for fuel) carbohydrate and protein present in the medium in which they develop, they invariably choose carbohydrate in preference to protein. Proteolytic activity, which is only indicated when the bacteria use protein, produces alkaline and nitrogenous substances. On the contrary, the products of fermentation,

which are formed when bacteria are using carbohydrates, are non-nitrogenous and acid substances.

The investigations of KENDALL and his collaborators were made on a certain number of groups of bacteria, including *B. coli*, the *proteus* group (including organisms found associated with putrefying matter) and the group *Mucosus capsulatus* (a badly defined group including *B. lactis aerogenes* and *B. acidilactici*). The organisms were grown in two broths one without sugar and the other containing 1 % of dextrose or other carbohydrate. The broth was in flasks, and experimental conditions were purposely very favourable to putrefaction; the relatively large free surface in contact with the air assured the oxygen necessary for the organisms both in the sugared and sugar free media.

The experiment showed that the addition of sugar to the latex, preventing putrefaction (originally observed by EATON and GRANTHAM) (1) and bringing about an increase in the degree of acidity (shown by GORTER and SWART), appears to be in exact accord with the principles established by KENDALL's researches. It would not appear necessary to assume, as GORTER and SWART and EATON think, that the addition of sugar to the latex produces conditions favourable to certain kinds of bacteria attacking sugar and forming acid, and unfavourable to other species of bacteria causing putrefaction.

The change in the character of the food supplied suffices to explain that putrefaction, accompanied by alkalinity, and fermentation are caused by the same species of bacteria under different conditions. It seems probable that independently of the anti-coagulating effect attributed to the production of alkali associated with the latex, the causes of the putrefactive activity which is exhibited in the latex must be looked for elsewhere.

It seems that proteolytic activity in the latex may have an anti-coagulating influence greater than that due to the neutralisation of acid by the alkali produced by the latex itself.

896 - **Investigations on Sugar Cane in Java.** - KUYPER, J., I. Evaporation curves for 32 kinds of sugar cane in 1916, in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXV, pp 812-821 Soerabaja, 1917. II Experiments with the object of demonstrating that the process of assimilation by sugar cane depends on external conditions *Ibid.*, pp. 1523-1549, 2 fig.

SUGAR CROPS

I. — The author determines the degree of evaporation at different times of the day; he takes as a basis the results obtained for dividing the kinds of sugar cane into 3 groups.

II. - - The author determines the amount of assimilation by sugar cane at different times of the day; to do this he makes use of (1) the method of weighing by means of GANONG's apparatus; (2) the iodine reaction (SACHS' method).

It appears from these experiments that the cane attains its maximum assimilation during the morning; in natural conditions sunshine hardly every appears to be a minimum factor. To investigate the influence of light part of the plantation was shaded by a roof.

(1) See R. April 1916, No. 506 and Sept. 1917, No. 858 (Ed.).

897 — **Statistics of Production of Various Kinds of Sugar Cane in Java.** — VAN HARREVELD PH I. Preliminary remarks on the statistics of production classified according to the different kinds of cane, in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXV, pp. 1573-1584. — II. Statistical tables of the distribution and production of various kinds of sugar cane in the crop of 1912. *Ibid* pp. 1589-1596, 2 fig. Soerabaja, 1917.

I. — The author discusses the general statistical methods employed by the Java sugar industry. He deals successively with the following points : — the requisite precision which the figures ought to have ; value of statistics of production for different varieties of cane ; importance, to the sugar industry of the cultivation of new varieties of sugar cane at experimental stations.

II. The author publishes 4 tables ; number 1 indicates the area planted with the three most important varieties 100 P. J. O., 247 B and Black Cheribon in different plantations ; in table 2 these figures are grouped according to districts ; table 3 shows the production of each variety in different plantations ; in table 4 these figures are brought together for the whole of Java.

For each variety the production is grouped according to the variety which furnished the cutting from which the canes were grown.

898 — **Description of Sugar Cane Varieties Cultivated in Java.** — JESWIET, J. in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, 3rd article in year XXIV, pp. 1321-1349 + 20 fig., 4th article in Year XXV, pp. 331-352 + 12 fig., 5th article in Year XXV, pp. 913-946 + 15 fig., 6th article in Year XXV, p. 1369-1411 + 20 fig., 7th article in Year XXV, pp. 1939-1994 + 19 fig., 8th article in Year XXVI, pp. 383-409 + 14 fig. Soerabaja, 1916, 1917 and 1918.

The author describes the varieties of sugar cane grown in Java according to principles previously explained. Each article is illustrated by plates and diagrams which help identification.

As far as possible the origin of the varieties is indicated. The author deals successively with the following subjects : —

3rd Article. — Several kinds whose yield is small are often mixed with the type 100 P. O. J., which gives excellent results. These are the varieties Loethers, Fiji, White Manilla, 100 Brun, red German New-Guinea, and Kassoer.

4th Article. — Among some plants raised from seed at the Sempalwadak plantation, type S. W. 3 has some importance for cultivation on a large scale.

5th Article. — Principal kinds of type F. K. At present F. K. 28 gives the highest yield of all the varieties grown in Java ; F. K. 2 is also a very good variety.

6th Article. — Some plants raised from seed belonging to the progeny of the Chunnee type owe to their origin their immunity from "sereh" ; they were obtained at the experimental station of Pasoeroean.

7th Article. — Some varieties resulting from a crossing between kinds of different origin are often cultivated on a small scale in plantations.

8th Article. — Description of 5 types D. I., among which D. I. 52 is important owing to its high sugar content and to its lesser tendency to lodging.

899 - **Specific Gravity of Some Kinds of Sugar Cane at the of Condang Lipoero Factory in 1916.** — SCHMUTZER, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXVI, pp. 545-647, 74 tab, 47 fig. Soerabaja, 1918.

The author has investigated to what extent the specific gravity can be used as a basis for fixing the best time for harvesting the cane. He commences by making a detailed study of the specific gravity of cane, which is complex: it is made up of the specific gravity of the sap and that of the tissue. The specific gravity of sugar cane increases progressively during the period of ripening and this increase is greater than that of the specific gravity of the sap only; it follows that the increase is caused chiefly by the increase in the specific gravity of the tissue. The latter increases owing to continuous contraction of the culm which the author has measured exactly. A close relation exists between the contraction and the absorption of water by the plant.

The author arrives at the conclusion that the determination of the specific gravity can give no indication of the time of perfect maturity but that it might perhaps help in estimating the weight of cane.

900 - **Distribution of Soluble Matter in the Sap in Different Parts of the Culm of Sugar Cane.** — KUYPER, J., in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXVI, pp. 1665-1686. Soerabaja, 1918.

The author determines the concentration of sugar in the sap in different parts of the culm by means of the Zeiss saccharo-refractometer. The percentage of soluble matter diminishes regularly from the lower to the upper parts of the same culm; up to the 10th internode from the top the diminution is insignificant; it becomes accentuated below that internode. However, the extreme tip contains rather more concentrated sap.

Below and above the node there is a zone of 1 to 2 cm. where the sap is less concentrated than in the middle part of the internode. In most cases the sap is more concentrated in the outer part of the culm than in the inner part; the cortical layer, which is the hardest part, contains the most concentrated sap. Numerous figures show these results.

901 - **Coffee Cultivation in Madagascar.** — FAUCHÈRE, A. in *Journal d'Agriculture tropicale*, Year XIX, No. 159, pp. 267-268. Paris, May 31, 1919.

Coffee cultivation is rapidly extending in Madagascar and just now it is favoured by the Act of August 5, 1913 which completely exempts coffee grown in French Colonies from customs duty in France.

In recent years the production, which was 200 tons, was almost confined to the Mananjary valley. Now the coffee plantations have spread generally at Vatomandry, Tamatave, Antalaha, Nosy-Bé, etc.

The Mananjary planters grow chiefly Liberian coffee (*Coffea liberica*) and they have evolved the most suitable method of cultivation for it. The investigations now bear on preparation. Liberian coffee is, indeed, rather difficult to treat, as pulping the berries is a very delicate operation. After many attempts the Java planters have learnt how to construct machines which pulp the Liberian berries perfectly and by carefully thought-out methods of preparation they place on the market a coffee which is valued as highly as good Arabian coffee.

STIMULANT,
AROMATIC,
NARCOTIC AND
MEDICINAL
PLANTS

The Madagascar planters have already introduced the machines used in Java for pulping Liberian coffee and they are investigating methods of preparation which will enable them to turn out coffee similar to that of the Java planters. Trade requires Liberian coffee of a light colour, which coffee merchants call "canary yellow", and this is the colour which is indispensable. The "moist" process of preparation is the only one which gives this result and soon the Madagascar planters, many of whom still prepare their coffee by the "dry" process, will use the pulping machines.

For the last few years, also, *C. canephora* var. *kouilouensis* and *C. robusta* (1) have been planted on a small scale generally in the colony. These species are earlier than *C. liberica* and their berries are more easily prepared. Their resistance to *Hemileia vastatrix* is, if not complete, at least very great, and there is no doubt that the planting of these coffees in Madagascar will be greatly extended. *C. congensis* var. *Chalui*, which is absolutely resistant to *Hemileia*, unfortunately produces little and its cultivation is being abandoned.

Attempts to bring the extensive marshes on the east coast of Madagascar under cultivation are at present being made and, according to the author's observations near Tanatave, properly drained marshes seem to be admirably suited to the cultivation of Liberian coffee.

It may be expected that Madagascar will soon export 1000 tons of coffee a year and the production will rapidly increase.

902 - **The Coffee Industry in Panama.** — SNYDER, A. G. in *Commerce Reports*, No. 117, pp. 884-885. Washington, D. C. 1919.

Panama presents a very favorable field for the growing of coffee, and there is quite a colony situated in the district of Boquete, Province of Chiriqui, engaged in the industry; but the coffee lands of Boquete are limited and nearly all the good land is occupied. The best district for the raising of coffee is situated in the uplands of the district of Bugaba, where vast areas of the very best lands for coffee-growing exist and where climatic and other conditions are most favorable to its growth. Coffee from this section is classified as the best in the world's market. Grown at an elevation of from 2000 to 5000 ft., it not only reaches perfection, but the altitude provides a healthy cool, salubrious climate.

After selecting a suitable piece of land, the timber is felled and generally burned, then the land is lined off and the young coffee trees are transplanted from a nursery which has been previously prepared, or with trees brought from a nursery. To prepare a nursery, the ground is properly cleared and the coffee berries are planted about 6 inches apart, and in a few weeks they begin to show above ground. They may be transplanted at a year old, but generally at two years, after which they require two years to begin bearing, and at four years are in full bearing, averaging 3 lb. per tree. No shade is required and the only cultivation consists in three or four cleanings a year to keep down the weeds, as no ploughing, etc.

(1) For *C. robusta* and its cultivation in Ceylon see R., March 1919, No. 322 (Ed.)

is necessary. Coffee matures from October to January, and is then picked and taken to the factory, where it is fermented, after which it passes to the pulper where the outside hull is removed; then it is washed and dried, either by the sun or in patent driers. It is known as *pergamino*, each bean being incased in a thin shell, which is removed by a sheller; it is then graded and sacked, ready for market. Water power being abundant, this is used for running all the machinery, which is simple and requires no expert to operate it.

The annual output of the Province of Chiriqui, which produces the bulk of the coffee, is approximately 4000 sacks of 100 lb. each, all of which is produced in the Boquete at present, as the coffee planted in the Bugaba section is still young and unproductive. The local supply does not meet the domestic demand, and instead of exporting, a great deal is imported from adjoining countries, although there is a protective tariff.

Coffee at present brings 20 cents per lb. without sacks. Labour is plentiful and is paid at the rate of \$1 per day. Most of the work is done by piece or contract. The cost of bringing a coffee plantation into bearing is about 70 cents per tree, which it is then valued at \$1. This cost includes land, cleaning, felling timber, nursery, transplanting, and care. Most of the timber may be used for lumber, which commands a good price, as well as for the construction of all buildings. Catch crops may be planted between the trees the first two years. The climate is exceptionally healthful and the soil will grow anything planted, products of the temperate and torrid zones thriving side by side. In good soil 400 trees may be planted to the acre. The yearly cost of maintenance is about \$10 per acre.

903 - **Present Condition of the Cultivation and Production of Tobacco in Italy.** — See No 1000 of this Review

904 - **Some Medicinal Plants of the Philippine Islands.** — GUERRERO, L. M. (Proceedings of the Manila Medical Society), in *The Philippine Journal of Science*, Vol. XIII, Sect. B, No 2, pp 123-124 Manila, March, 1918

The flora of the Philippines is rich in pharmaceutical plants which the natives use largely and which deserve to be scientifically studied with a view to their possible use in pharmacy. Among them the author notes: *Alstonia scholaris* used as a febrifuge and sometimes as a cardiac remedy; *Limasia amara*, employed as a gastric sedative; the seeds of *Quisqualis indica* employed as a vermifuge; *Tylophora brevipes*, similar to *Tylophora asthmatica* of India which contains an alkaloid, tylophorine, and which is used as an emetic, antidiysenteric and expectorant.; *Tinospora reticulata*, used against malaria and which probably contains berberine.

905 - **Report on Work Done at the Java Cinchona Experimental Station in 1916-1917.** — *Mededeelingen van het Kina-Proefstation* N. V. Bandoeng 1918.

Investigations are described regarding — the morphology of the flower and fruit of cinchona; the influence of moisture and air on the germination of cinchona seed; injury to cinchona seed freshly sown in nurseries by insect attacks. This last investigation was carried out by

Dr. BERNARD, Director of the Experimental Station for tea. He noted that various species of mites can be very harmful, a fact hitherto unknown. Lastly, the commencement of an investigation regarding the influence of the drying temperature on the alkaloid content of the bark is described.

- 906 - **Experimental Cultivation of Insecticidal pyrethrum (*Pyrethrum cinerariae-folium*)** (1), at the "Regio Giardino Coloniale" Palermo. — BORZI, A., in *Bollettino di Studi ed Informazioni del R. Giardino coloniale di Palermo*, Vol. V, Fasc. 1-2, pp. 45-50. Palermo 1919

Although the cultivation of the insecticidal pyrethrum had previously often been recommended in Italy, it is only in the last few years that experimental cultivation of any importance has been carried out on the initiative of the Palermo colonial garden. These experiments have been successful and have chiefly been made with the object of utilising waste land unsuited for ordinary agriculture. The product of the Palermo colonial garden crop, in the form of powder and smoke cones, has been found to be very good. To advertise it, it has been largely distributed to farmers, and to encourage cultivation considerable quantities of seed have been given to those who asked for it.

In the article here summarised, the author draws attention to the importance of the plant and indicates the methods of cultivation which the experiments at the Palermo colonial garden lead him to recommend.

FRUIT
GROWING

- 907 - **Abnormal Growth of the Graft compared with the Stock in Certain Cultivated Almond Trees, in Italy.** — PASSERINI, N., in *Bollettino della Società botanica italiana*, No. 1, pp. 6-7, 1 fig. Florence, Jan. 1919

The greater development of the graft compared with the stock is a fairly common fact, but seldom is the difference in their diameters so great as that observed by the author for some almonds grafted on plum stock in the orchard of the Agricultural Institute of Scandicci (Florence). For example, the girths above the graft, below it, and at the base of the stem 10 cm. above the ground, for 5 trees were respectively, in cm. - (1) 108, 68, 59; (2) 86, 53, 47; (3) 76, 49, 36; (4) 65, 45, 37; (5) 72, 50, 46

It appears that the greater growth of the graft has influenced the stock which has grown in the shape of an inverted, truncated cone. The trees, which were about 25 years old, in spite of the abnormal development of their trunks grew and fruited normally and were never broken by wind. They aged prematurely, but this may have been due to excess of lime in the soil.

- 908 - **The Cultivation of Fruit Trees in Indo-China.** — I CHEVALIER, AUG., in *Bulletin agricole de l'Institut scientifique de Saigon*, Year I, No. 4, pp. 97-111. Saigon, April, 1919.
— II MILVILLE, R., *Cultivation of European fruit trees at Laos and Tonkin*, *Ibid.*, p. 111-115.

I. — This study seeks to show that with a little trouble Indo-China might be enriched with a number of useful trees which are still lacking or

(1) See *R.* April 1917, No. 372; *R.* Dec. 1918, No. 1361. (Ed.)

which are only represented by rare specimens or by worthless varieties only fit for use as stock for grafting or for experimental crossing.

By introducing fruit trees, which is more or less difficult, Cochinchina might be made one of the leading countries for the production of tropical fruit. On the other hand, Tonkin and the high table-lands of Laos and Annam might produce, dried for export, most fruits of the temperate zone which would have a good market in Europe.

The author does not pretend to deal in his note with all the plants which are capable of producing table fruit in Indo-China: he refers for complete information on this subject to a recent book by MM. C. CRÉVOST and C. LEMARIÉ entitled "*Catalogue des produits de l'Indochine*, I (1915) pp. 191-285 (Fruit trees). His aim has been to draw attention to the more important kinds and to note the varieties to be introduced or spread and how to multiply them. He has grouped these species in classes according to the conditions in which they grow. The following is a list of the species which he studies successively one by one:—

KITCHEN-GARDEN PLANTS. — Melon (*Cucumis Melo* L.) "Dua tây" in Annamite; water-melon (*Cucumis Citrullus* Schrad) = "Dua do"; tomato and "Pok-pok", Winter Cherry or alkekenque (*Physalis peruviana* L.); Strawberry (*Fragaria*, hybrids of various species) = "Phuc bôn tu" (according to Loureiro) = Dân-tây (Tonkin), plantains and pineapples.

TROPICAL FRUIT TREES. — Citrus fruits; mangosteen (*Garcinia Mangostana*); mango (*Mangifera indica* L.) of which the best varieties are:— "Xoài voi" (*M. indica* L. var. *Cambodiana* Pierre), "Koai thanh ca" (*M. indica* L. var. *Mekongensis* Pierre), "Xoài com", "Xoài mut", "Xoài tay" and "Xoài gon"; alligator pears (*Persea gratissima* L.); sapota (*Achras Sapota* L.); *Lucuma mammosa*; *Chrysophyllum*; *Bassia*, etc.

SUB-TROPICAL FRUIT TREES. — Lichi (*Litchi sinensis* Radk.) of which the best Tonkin varieties are:— "Vai-coc", "Vai-tien", "Vai-chung" and a new variety without a stone; Japanese Medlar or Loquat (*Eriobotrya japonica* Lindl.); "Thanh mai" (*Myrica integrifolia* Roeb.); *Feijoa Sellowiana*.

FRUIT TREES FROM TEMPERATE COUNTRIES. — Apricots; peaches (especially var. *mammosa*); plums; apples; pears (*Pyrus sinensis*); cherries; etc.

Indo-China might take a leading position in the production of dried fruits in slices, preserved fruits in syrup, jams and marmalades.

A fruit-preserving industry might already be carried on in Indo-China by using the many fruits on the market, at any rate at certain seasons of the year, and by sowing or planting kinds which develop rapidly. Nevertheless the profits of such industry would be contingent on circumstances. For the future, there is every necessity to introduce into Indo-China representatives of the finest varieties of each species and spread them everywhere where they can grow. In a few years the fruit resources of the country could be considerably increased and improved. The programme to be undertaken, and which the author supports, is as follows:—

- (1) To introduce into Indo-China the best varieties of all the fruit

trees which can grow there ; this is the rôle of the Scientific Institute of Indo-China which owns the botanical garden at Saigon.

(2) At each station, to create extensive nurseries for fruit trees of indigenous kinds, the quality of which is often inferior but which would serve as stock on which the good imported varieties could be grafted.

(3) To train native grafters and gardeners at special stations of the scientific Institute.

(4) To distribute to local agricultural services, seed, plants, or cuttings of the best imported varieties so as to spread them.

(5) Tours of inspection by a specialist of the scientific Institute.

(6) To start a nursery for fruit trees and a small orchard in connection with each village school.

(7) To distribute, gratis, to the school children of each school the plants raised in the school nurseries.

(8) To organise horticultural shows, with prizes.

(9) To advertise in France preserved and dried tropical fruit and facilitate their sale.

This is a long programme. The main thing is to begin to carry it out. The following study shows that this task has already been begun.

II. — The note gives very interesting information regarding the first serious attempts to acclimatise European fruit trees in Indo-China. The author, in 1919, made a preliminary series of experiments at Chapa in Upper Tonkin at an altitude of 5000 ft. Unfortunately his experiments had to be interrupted ; but many of the trees introduced or grafted remained alive and, in 1918, he renewed his attempts and sent grafts to Xieng Khouang, to Tranninh, also at an altitude of 5000 ft., encouraged by M. BARTHELEMY, Commissioner of the French Government in the Province of Laos where the climate is somewhat like that of France and wheat, hemp, etc., are grown.

909 — **The Cider Apple of the High Plateaux of Indo-China (*Pyrus Doumeri*).**

— CHEVALIER, AUG., in *Bulletin agricole de l'Institut scientifique de Saigon*, Year I, No. 5, pp. 142-145. Saigon, May 1919.

There are in various parts of Indo-China, in Cambodia, in Laos, in Annam and in Tonkin, mountains covering large areas and tablelands some of which are extensive, at an altitude of from 800 to 2000 m. with a temperate climate, and where the indigenous flora is similar in some respects to that of Europe and North America, with forests of conifers, oaks, horse chestnuts, laurel, magnolias mixed with scattered maples, ash, holly, woodbine, rhododendron, and rosaceous trees resembling pear trees.

On certain parts of these mountains, notably in Upper Tonkin, the natives, generally very scattered, already cultivate wheat, buckwheat, Italian millet, hemp, opium poppy and a great many European fruit trees. Although the greater part of these regions is difficult of access, there is no doubt that, some day, roads and railways will penetrate these mountains and the cultivation of the principal European plants will then become prac-

licable. In No. 4 of the *Bulletin agricole de l'Institut scientifique de Saigon* (1), the author has already drawn attention to the cultivation of European fruit trees : — peach, apricot, plum, cherry, fig, walnut, apple, pear, etc., as having a great future, especially if it is undertaken with a view to the manufacture of preserved fruit, jams and marmalades and for the preparation of dried fruits. The existence, round villages and pagodas in the high country, of degenerate varieties growing vigorously and sometimes, in the forest, of indigenous species closely related to cultivated kinds and which would serve either as stock for grafting or for hybrids which have not yet been tried, gives rise to the hope that the cultivation of European fruit trees may be developed practically. Some of the indigenous species appear to be suitable for immediate utilisation in the production of wholesome beverages if a little trouble is taken with their cultivation. To this class belongs the apple, which is the subject of the author's article, and whose fruit rots unused every autumn in the hill forests of Indo-China.

The author will relate in his next article the attempts which have been made to cultivate the vine and make wine in Indo-china. They have all failed. During the recent war, when owing to submarines and want of shipping, it became difficult to keep Indo-China supplied with French wines, certain merchants imported Californian and Australian wines into Indo-China, which were sold at high prices and generally did not give satisfaction.

The few Europeans resident at Tranninh then had the idea, on the advice of M. R. MIVILLI, of making cider with the fruit of a wild apple found there in fairly large quantities. Every one who drank this cider found it agreeable, although it was manufactured in a primitive manner. It could certainly be improved. Consequently, the author wishes to have experimental plantations of this apple made on the plateau of Lang-Bian this year. At Tranninh, M. R. MIVILLI has already made an orchard where he proposes to grow 100 000 apple trees commencing from this year. Consequently it seemed to the author that it would be interesting to study, as completely as possible, the apple tree in question and its fruit. This apple has been known for the last twenty years as "Lang-Bian Apple" (JACQUET) and about fifteen years ago M. DÉSIRÉ BOIS described it under the name *Pirus Domeri* Bois.

The fruit of this apple tree weighs generally from 50 to 75 gm., has a diameter of 5 to 6 cm, is green at first but when it is ripe and falls to the ground it is light yellow spotted with red-brown and then exhales a pleasant odour resembling that of quince and pippin; the pulp of this apple is firm, not juicy, has a rough acid taste, when freshly cut it is yellowish white, turning brown afterwards; it is scarcely edible.

The author gives the results of analysis of the Lang-Bian apple, of the fermentation of its juice, of the analysis of the lees, and that of Tranninh cider. Lastly, he gives much information about the culture and selection of the apple and about the manufacture and preservation of the cider.

(1) See No. 908 of this *Review* (F.1)

910 - "Alexander Lucas" a Variety of Pear Successfully Introduced into Sweden. — LIND, G. in *Kungl. Landbruks-Akademiens Handlingar och Tidskrift*, Year LVIII, No. 2, pp. 57-58. Linköping, 1919.

In 1911, a plant of the pear "Alexander Lucas", grafted on quince, was imported from Germany into Scania (South Sweden). This tree gave, in 1915, fruit which in cold storage preserved perfectly its bulk and flavour, which is not the case for other varieties in that country.

This variety, therefore, is of first-rate importance, for a pear which would keep during the whole winter was long sought for in Sweden; now the "Alexander Lucas" pears kept in cold storage can be eaten in the months of January and February of the following year; keeping them simply in a cellar is sufficient to preserve them in good condition up to Christmas of the year in which they were grown. Nurseries of "Alexander Lucas" made in Scania are developing well.

911 - **The Almond in California.** — TAYLOR, R. H., in *University of California Publications College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* 297, pp. 3-72, 28 figs., Bibliography of 13 publications. Berkeley, August, 1918.

The writer deals with the following points regarding the almond tree: its habits (different growth periods, cultivated varieties, pollenisation etc.); its requirements with regard to climate and soil; districts suitable for almond-growing; selection of stocks (where the most desirable conditions of soil, moisture and drainage exist, the almond does best on its own root; where the moisture is variable the peach is perhaps the most satisfactory stock; within the last few years, the United States Department of Agriculture has introduced a Chinese peach, *Prunus Davidiana* which promises to be a very desirable stock on alkaline soils; the Myrobalan plum and the apricot are not good stocks; as a rule the almond is not grafted); pruning; culture and the effect of culture upon the crop; orchard heating for frost prevention; crop handling; marketing; yields; costs of production; diseases and enemies; varieties; methods of classification of almonds according to hardness of shell.

California produces over 98 per cent. of the entire American almond crop, but the supply does not suffice to meet the demand, and many almonds are imported from Spain and Italy (1).

Experiments made by TUTTS in the University Farm orchard at Davis, California, show that practically all varieties of almond are self-sterile and that many are intersterile. Non pareil and I. X. L. are intersterile, though both are interfertile with Ne Plus Ultra.

The Languedoc and Texas varieties are intersterile; I. X. L. and Peerless are practically intersterile. The California variety has proved the best polleniser thus far tested for varieties blooming near it. The Drake variety is interfertile with Non Pareil, I. X. L., Ne Plus Ultra, Peerless and Jor-

(1) According to the recent census published in the *Monthly Bulletin of the State Commission of Horticulture*, Vol. CIII, No. 4, Sacramento, Cal., April, 1919, California possess 14 153 hectares of almond trees bearing fruit and 6465 hectares of almond trees not yet in bearing; the average annual crop is 46 883 tons (14)

dan, that is to say, with all the varieties which have been tested. I. X. L. is interfertile with Drake; Jordan, California, Languedoc, Ne Plus Ultra and Texas. Ne Plus Ultra is interfertile with California, Drake, I. X. L., Languedoc and Nonpareil.

The approximate order of ripening of the best and commonest varieties is : — 1) Nonpareil ; 2) I. X. L., Jordan ; 3) Ne Plus Ultra ; 4) Peerless, Princess, California, King, Silver ; 5) Golden State ; 6) Lewelling ; 7) Drake ; 8) Languedoc, Texas.

The average number of almonds per pound, the average percentage of kernels to whole nuts and the average percentage of double kernels (which is a defect) in the different varieties is as follows : —

Varieties	Average number of almonds per lb.	Average percentage of kernels to whole nuts	Average percentage of double kernels
Nonpareil	236	66.6 %	3.05 %
I. X. L.	152	52.28	0.60
Ne plus ultra	167	56.15	7.37
Drake.	145.5	44.48	8.54
Languedoc	211	49.16	0.97
Texas	173	43.89	10.29
Reams	140.5	45.27	9.51
Lewelling	150	49.96	29.50
Peerless	124	36.05	6.62
Princess	238	70.6	1.88
California	216	70.13	0.032
King	241	71.2	1.14
Harriott	167	53.68	0.88
Jordan	74	25.23	2.93

Average cost of production of all bearing orchards in California.

Expenses	\$ per acre
Pruning	3.00
Ploughing	2.75
Harrowing75
Cultivation and grass cutting	3.00
Spraying	3.00
Irrigation	2.00
Harvesting, hulling, ct	20.00
Warehousing (including bleaching)	1.75
Miscellaneous expenses for maintenance and handling	2.00
Overhead charges	38.00
Total cost per acre . . .	\$16.2

Returns.

Average yield per acre 700 lb.

Average returns per acre \$97.30.

in the thickness of the parenchyma and in the activity of its tissues. The chlorophyll corpuscles in the leaves so treated are smaller, more numerous, less separated and, however, richer in chlorophyll". It is, perhaps, not too paradoxical to believe that the leaf feeds better when it transpires less. This is a hypothesis which needs to be proved by further research and study.

II. — The above observations of M. CADORET fully confirm the results of experiments made by M. CASTANA in 1916 and 1917 and published in *Propaganda agricola*, Bari, January 31, and November 30, 1917.

In his comparative experiment in fighting mildew, the author has shown the great superiority of Bordeaux mixture over Caffaro paste and 10 % cupric powder, and he emphasizes the fact that the leaves of the vines were, during the whole period of vegetation, very green in the plot treated with Bordeaux mixture, not so green in the plot treated with Caffaro paste, and still less green in the plot treated with cuprix powder. Further, in the plot treated with cupric powder, the leaves dropped off during the first 10 days of November, while they did not do so until the second 10 days in the plot treated with Caffaro paste, and not until the beginning of December in the plot treated with Bordeaux mixture. The author's experiments were made in the experimental vineyard attached to the nursery for American vines at Ascoli Satriano (Foggia) where vine stock of the Troia, Montepulciano, Malvasia, and Aglianico varieties are cultivated, and which is situated on hilly ground with shallow, dry, unfertile soil.

Having repeated his experiments in 1918 with the three fungicides the author was able to note that Bordeaux mixture in addition to its very strong fungicidal action, has also the property of increasing the vigour of the vines and, an important matter in southern vineyards, of making them much more resistant to drought. While, owing to the persistent drought of 1918, in the plots treated with Caffaro paste and 10 % cupric powder, the 4 above-mentioned vine-stocks have leaves of a glaucous green colour, pale, slightly shrivelled and rather yellow near the base of the vines, in the plot treated with Bordeaux mixture, on the contrary, the leaves were larger, perfectly spread and of a fine dark green colour.

The beneficial action on the growth of the vines is due to the copper hydrate which forms when the solution of sulphate of copper is mixed with that of calcium hydrate; but the oxychloride of copper contained in Caffaro paste does not appear to have any physiological action on the vines.

914 — Vines yielding Aromatic Grapes and Liqueur Wines in Apulia, Italy. — PROSPERI, V. (R. Cantina Sperimentale di Barietta), in *La Propaganda Agricola*, Year XI, No 8, pp. 81-86. Bari, April 30, 1919.

Experiments made during the past 10 years at the "R. Cantina sperimentale" at Barietta show that aromatic grapes grown in Apulia can make very fine liqueur wines, among which muscatel ranks first; for production "aleatico", "zagarese" and malvoisie rank next. The localities which are most suitable for the cultivation of aromatic grapes

are those situated along the coast with hard-pan (1) and rich in lime where the Berlandieri \times Ripara 420 A and 34 E (the former in the drier zones and the second in the moister parts) are very successful as stock for grafting on, for they have strong affinity for muscatel and "aleatico" vines and give quality to the wine produced.

In the climate of Apulia, muscatel is one of the earliest ripening vines. Its grapes are already ripe early in August, but, to obtain the maximum concentration of sugar, it is well to put off gathering the grapes until September, when the grapes contain 30 to 32 % of sugar on suitable soil. "Aleatico" and malvoisie ripen a little later and have a sugar content of 28 to 30 %.

It is indispensable to employ specialists for making liqueur wines; for this reason the author recommends cooperation between vine growers for the manufacture of such wines.

915 - **The Seedless Raisin Grapes in California.** — BIOLETTI, F. T. in *University of California Publications, College of Agriculture Agricultural Experiment Station, Berkeley, California, Bulletin* No. 298, pp. 75-86 Berkeley, September, 1918

Information respecting: - the importance of the raisin and seedless raisin industry in California, varieties; origin; cultivation; soil requirements; cost and returns. At the end of the Bulletin, there is a table giving the yields of seedless vines in the experiment vineyards of the University of California.

The raisins of the world are of 4 main types:— 1) of large size made principally from the muscat of Alexandria grape, and known generally as Muscat, or Malaga raisin; 2) of medium size, light coloured and seedless, made principally from the Sultanina grape and known as Sultan raisins; 3) of small size, dark coloured and seedless made chiefly from the Black Corinth grape, and known in English as currants; 4) of various sizes, colours, and seedless made from almost any variety of grape, and usually known as dried grapes. The writer only deals with the second and third types.

The principal raisin-producing countries of the world, in order of importance, are:— Greece, California, Turkey, Spain and Australia; their production in short tons in 1913 and their percentage of the world's production is as follow: Greece (currants) 180 000 tons, 60 %; California (Muscats and Sultanas) 65 000 tons; 22 %; Turkey (Sultanas) 23 000 tons, 8 % Spain (Muscats) 20 000 tons, 7 %; Australia (Muscats and currants) 14 000 tons, 3 %. In 1916, California produced 132 000 tons of raisins (which shows how enormously the industry has increased in 3 years), of these 74.4 % were muscats and 25.6 % Sultanas.

The seedless grapes most grown in California are:— Sultanina; Rose Sultanina (Sultanina Rosea table grape imported from Italy); Giant Sultanina (Curiosity for collections); Sultana (black grape); Black Corinth; White Corinth (white grape making excellent currants, but not equal to the black); Black Monukka (table grape); Seedless Muscat.

(1) See R., May 1919, No. 560 (Ed.).

In 1916, 73.2 % of the seedless raisin grapes, were grown in Fresno County, 13.2 % in Sacramento Valley ; 10.8 % in Tulare County ; 10.5 % in Sutter County.

On rich soil, 518 Sultana vines, 444 Sultanina, and 340 Corinth are planted per acre ; on poor soil 605 vines of each three varieties are planted per acre. The following table gives the estimated cost of a vineyard on good land (irrigation not included, as it varies too widely), planted with resistant trellis vines.

First year	Land	\$200.00	
	Bench grafts (500)	30.00	
	Preparation of land	15.00	
	Planting	10.00	
	Cultivating	5.00	
	Interest and taxes	15.00	
	<i>Cost the first year</i>	—	\$275.00
Second year	Pruning	3.00	
	Staking	10.00	
	Replanting	5.00	
	Cultivation	5.00	
	Handwork	10.00	
	Interest and taxes	22.00	
	<i>Cost of second year</i>		55.00
	Pruning	5.00	
	Cultivation	5.00	
	Handwork	10.00	
	Trellising	55.00	
	Interest and taxes	25.00	
	<i>Gross cost third year</i>	\$100.00	
	Crop, one ton at 4 cents net.	80.00	
	<i>Net cost third year</i>		20.00
	<i>Total cost</i>		\$350.00

Estimated Profit of Sultanina Vineyard.

(Valuation of \$350 per acre).

Profit per acre at 5 cents per pound.

Annual cost of maintenance: —

Pruning and tying	\$12.50
Ploughing and cultivating	7.50
Hand work	10.00
	\$30.00

Vineyard work: —

Interest and taxes	\$28.00
Depreciation	10.00

Fixed charges **\$38.00**

Total **\$68.00**

Harvesting, drying and hauling raisins per ton **17.50**

Profit per acre at 5 cents per pound.

Crop pounds	Gross returns per acre	Cost per acre	Net returns per acre
2 000	\$100.00	\$85.50	\$14.50
3 000	150.00	94.25	55.75
4 000	200.00	103.00	97.00
5 000	250.00	111.75	138.25
6 000	300.00	120.00	179.50

916 - **The Golden Chasselas of the Garonne basin.** — VIALA, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 24, p. 667. Paris, July 2, 1919.

M. VILLA (Professor at the Institut National Agronomique) introduces to the Academy a work by M. CHARMEUX entitled *Le Chasselas doré du bassin de la Garonne*. For the last ten years the cultivation of the golden Chasselas has spread in the districts of Moissac, Montauban and the banks of the Garonne; it becomes more important every day. These Chasselas grapes begin to compete seriously with those of Thomery. This cultivation has so much increased that the production has gone from 5000-6000 tons ten years ago up to 14 000 tons in 1913; it dropped during the war, but in 1918 it rose again to 12 000 tons. This is very important from the point of view of establishing a new crop on the banks of the Garonne.

It is due to the incentive of the Orleans Company that the first efforts were made, which have led to such remarkable results; so much so that the golden Chasselas of the Garonne is not only eaten in France but there is an important trade in it with various European countries and even with the United States.

LIVE STOCK AND BREEDING

917 - **Leucocyto-gregarines and their Occurrence in South Africa.** PORTER, ANNIE (South African Institute for Medical Research), in *The South African Journal of Science*, Vol. XV, No. 5, pp. 335-336. Cape Town, Jan.-Feb., 1919.

HYGIENE

The writer has suggested the name of leucocyto-gregarines for the group of parasitic Protozoa occurring in the leucocytes of the blood of mammals. He mentions the leucocyto-gregarines seen by him since his arrival in the Transvaal in the dog, cat, rat, mouse, hare, rabbit and squirrel. Several specific names have been proposed for these parasites according to the genus of their host, namely *Leucocyto-gregarina canis*, *L. leporis*, *L. nigricollis*, *L. muris*, but it is quite likely that they are only varieties of the first-named species, *L. canis*. The parasites are at first small, vermicular organisms attaining the dimensions of from 8 μ . to 12 μ by 4 μ to 6 μ . Multiplication by schizogony was observed in some cases by the writer, but no definite sexual reproduction seems to take place in the blood of vertebrate hosts.

In the case of the dog, the parasite was apparently transmitted by the tick, *Rhipicephalus sanguineus*.

The pathogenicity of leucocyto-gregarines varies. In the dog observed by the writer, anaemia, rise of temperature and some diarrhoea

were remarked, and the disease ended fatally, as is often the case when it attacks other mammals.

918 - **The Causes of Death in the Case of Horses Undergoing Immunisation Treatment with Dead Bacteria, or Extracts of Bacteria.** — DEBAINS, E. and NICOLAS, E., in *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 6, pp. 324-327, Paris, February 10, 1919.

The writers have immunised a large number of horses with the object of obtaining antimicrobial serums, or serums that are both antimicrobial, and antitoxic. Several methods of immunisation have been employed, and the writers found in the course of the process, that fatal effects resulted from the intra-venous introduction of the antigen. Its virulence cannot be the cause of death, as the writers only used "dead antigens".

Death supervened after some minutes, or after some hours. Death occurred in a few minutes, in the case of horses that were undergoing immunisation treatment, and the attendant symptoms were always the same, *whatever antigen had been injected*. In the case of the fresh horses that were given the same amount of antigen and succumbed, death did not ensue until after a time varying from some hours to one day, or even longer.

This almost sudden death of animals during the course of immunisation treatment is due to hypersensibility.

It is necessary to ascertain whether we are dealing with the hypersensibility to bacterial proteins (demonstrated by the work of NICOLLE, LOISEAU, and FORGEOT), or with the hypersensibility to bacterial toxins (proved by the experiments of BEHRING, MARTIN, NICOLLE and POZERSKI).

The writers are of opinion, that it is a question of *hypersensibility to microbial toxins*, and give the following reasons in support of their view:—

1) Toxic antigens never kill new individuals in a few minutes, if they are injected in the same amounts as those used in the case of animals in course of immunisation.

2) Death may supervene as the result of sub-cutaneous injections; this never occurs in hypersensitive subjects when atoxic albumens are employed.

3) The *specific* neutralisation of the toxin prevents misadventure.

919 - **Immunity in Epizootic Lymphangitis.** — BOQUET, A., and NÈGRE, L., in *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 8, pp. 421-423. Paris, February 24, 1919.

Experiments on epizootic lymphangitis have shown the contrast between the extremely contagious nature of the disease, and the almost impossibility of reproducing it artificially. Most of the writers who state that they have obtained positive results were working in infected surroundings.

The writers have succeeded on several occasions in reproducing epizootic lymphangitis in the horse by means of inoculation with cultures of cryptococci (1) and the total results obtained show that re-inoculation greatly

(1) See *R. Dec.*, 1918, No. 1371. (*Ed.*)

increases the effect of the first inoculation. As regards the immunity obtained, the writers sum up their conclusions as follows:—

1) The subcutaneous inoculation of a culture of cryptococcus gives rise to a nodule which forms an abscess, and heals without spreading; the extension and generalisation of the initial lesion are produced by the re-inoculation of these cocci.

2) In the case of an organism rendered susceptible by a first inoculation, the incubation period of the re-infection nodule is shorter than that of the primitive one.

3) Animals suffering from natural, or artificially-produced, lymphangitis become slowly immune; *total immunity is not obtained until 50 days after the first inoculation.*

920 - **Epizootic Disease due to a New Species of Trypanosome attacking Cattle in French Guiana.** — LEGER, M., and VIENNE, M. (Cayenne Institute of Hygiene) in *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 5, pp. 258-266. Paris, May 14, 1919.

Several kinds of trypanosomiasis have been reported as occurring in South America in the form of more or less deadly stock diseases; some of them have become enzootic. These flagellate epizootic diseases occur naturally only among *Equidae*. However, recently, the writers have observed an epizootic malady caused by flagellates which had attacked 180 head of cattle in French Guiana. The symptoms of the disease resembled those of progressive, though slowly developing anaemia, but the result was almost always fatal. The animals slowly lost flesh; then there appeared a special œdema localised in the dewlap and the subglossial region; anaemia shown by the bloodless appearance of the different mucous membranes; intermittent diarrhoea; and then, during the last stage of the disease, loss of hair producing bald patches on the surface of the body and paresis of the hind-legs. In the case of cows, the usual milk supply is diminished by $\frac{2}{3}$ or $\frac{3}{4}$. The number of deaths is 52%. The trypanosomes are found in the peripheral blood in very variable numbers, being probably transmitted by the innumerable flies (*Tabanus* spp.) that torment the diseased herds.

The trypanosome measures from 22 to 23 μ in length (this includes the free flagellum of which the length is 6 μ) by from 1.50 μ to 1.75 μ in breadth. Guinea-pigs and dogs inoculated with the blood of infected animals have proved immune. The writers have tried to ascertain whether this trypanosome, which attacks cattle in French Guiana, can be identified with one of the flagellates found attacking *Equidae* under natural conditions in South America. It is worthy of notice that during the prevalence of the above-mentioned epizootic disease, no other species of animal was infected, and especially that the horse and donkey enjoy complete immunity. The trypanosome in question is entirely different from the *Trypanosoma equinum* of Caderas, and the *T. hippicum* of the mules of Ancon; it more nearly resembles *T. venezuelense*, the agent of the "boba" disease of horses in Venezuela, and *T. evansi*, the cause of "surra" (1). It should, however, be remarked,

(1) See R. June 1919, No. 746. (Ed.)

that not only are there distinct morphological differences between the pathogenic agents, but cattle are not attacked in Venezuela, and further, these animals are very resistant to "surra", those naturally infected in India recovering as a rule. In Mauritius, the mortality among cattle attacked by "surra" was only from 25 to 30 %, whereas 100 % of the infected horses died.

The trypanosome attacking cattle under natural conditions, and *cattle* only in French Guiana, thus appears to be a new species, and the writers propose giving it the name of *Trypanosoma guyanense*.

921 - A New Nematode causing Parasitic Gastritis in Calves. — SHEATHER, A L, in *Agricultural Research Institute, Pusa, Bulletin*, No. 86, pp 1-5 + V Plates, Calcutta, 1919

The parasite that is the subject of this note was found in immense numbers in the fourth stomach of several calves which had died, showing all the symptoms usually associated with parasitic gastritis, and there can be no doubt that it was responsible for the deaths.

A search through the literature has failed to reveal any reference to a nematode parasite having the characters of that described in this note, the distinguishing features of the worm being: — caudal bursa: trilobed with posterior lobe symmetrically placed; spicules: very long and slender; vulva: close to the posterior end of the body (about $\frac{1}{40}$). The worm does not fall into any of the established genera of the sub-family *Trichostrongylinae*, found in the fourth stomach and duodenum of ruminants.

922 - Cattle Scab Methods of Control and Eradication. — JMLS, M., in *Farmers' Bulletin* 1017, U. S. Department of Agriculture, 29 pp., 15 figs. Washington, December, 1918

A popular account of scabies in cattle. The writer dwells upon the following points: — the nature and habits of the mites causing this disease; the symptoms produced by the different species: (*Psoroptes communis bovis*, *Sarcoptes scabiei bovis*, (*Orioptes bovis* and *Demodex folliculorum bovis*); ways of distinguishing the various types of cattle scab; control of the disease by dipping and spraying. He gives a series of very clear figures showing how a dipping-vat for infected cattle may be constructed. The dips most recommended are the lime-sulphur dips made in the proportion of 12 lb. of unslacked lime and 24 lb. flowers of sulphur per 100 gallons of water, and nicotin dips (using at least 0.05 % of nicotin) either with or without 1.0 % flowers of sulphur; during dipping the temperature should be maintained at from 95° F. to 100° F. (35-36° C.) in the case of the nicotin dip.

Crude petroleum dips are an effective remedy against scab, but the oil is apt to injure the cattle.

923 - Treatment of Epizootic Aphthic Fever with Oxygenated Water According to Prof. Nello Mori's Method. — *Giornale di Medicina veterinaria*, Year LXVIII, No. 27, pp. 420-422. Turin, July 4, 1919.

As a result of his experiments carried out at the Experiment Station for Infectious Cattle Diseases at Portici, Naples, Prof. Mori has devised a treatment of epizootic aphthic fever based upon the use of official

oxygenated water. This method has given excellent results, not only at Portici, but also when practised by several veterinary surgeons.

Official oxygenated water should contain 10 volumes of oxygen and it should not have been prepared longer than two months.

In the case of cattle, this remedy is applied both locally, and in the form of sub-cutaneous injections. For the latter, which generally bring about a rapid and complete cure, the oxygenated water is used in the proportion of about 5 gm. per 100 kg. of live weight. The inoculations are effected every 24 hours, and as a rule 2 or 3 injections are sufficient to check the disease and cure the animal, even should the case be a serious one. In very bad cases two injections of the above strength may be given a day, at intervals of from 10 to 12 hours.

The immediate effects produced are: some dyspnoea, acceleration of the pulse and fits of coughing. After the first injection, an improvement in the general condition is observed. A little emphysema persists around the puncture; this is due to the liberation of oxygen. The subsequent inoculations must not be made at the same spot.

In the case of cattle, the secondary treatment consists in the daily application of oxygenated water to the lesions.

In that of sheep, goats, and swine, in which animals the disease is usually localised in the feet, and seldom in the mouth, local treatment may suffice to effect a rapid cure.

Oxygenated water has also been used by Prof. Moir in the treatment of other diseases.

924 - **Experiments on the Treatment of Rinderpest with Various Drugs, in the Philippines.** — BOYNTON, W. IL., in *The Philippine Journal of Science*, Vol. XIII, Section B, No. 2, pp. 95-121. Manila, March, 1918.

Experiments carried out for 6 ½ years in the Veterinary Division of the Philippine Bureau of Agriculture. The drugs used were: eosin, medicinal methylene blue (Merck), cacodylate of soda, atoxyl, quinine sulphate, camphorated oil, creolin, permanganate of potash, ergot, iodine, potassium iodide, gentian violet, adrenalin chloride, nuclein, formalin, chlorazene, alcohol, castor oil, extract of *nux vomica*, extract of gentian. The remedies were administered by means of intravenous injections, and were used either pure, or diluted with ox-blood serum. Of the 50 animals experimented upon, only 2 recovered from the disease, which is positive proof that the drugs used and administered as they were, had no curative power for an animal suffering from rinderpest.

925 - **Hemorrhagic Septicemia.** — WASHBURN, H. J. in *U. S. Department of Agriculture, Farmers' Bulletin* 1018, 8 pp. Washington, October, 1918.

A bulletin issued for the special purpose of teaching how this disease can be recognised and prevented.

Hemorrhagic septicemia is a contagious disease caused by *Bacillus bipolaris septicus*; it is known as stockyard fever, when it attacks cattle; swine plague (contagious pneumonia), and is not easily distinguished from hog cholera; fowl cholera when it attacks fowls, pigeons, geese, etc. In

swine and sheep, the malady often assumes an acute form (pneumo-enteritis) and death ensues in a few hours. No form of treatment has time to become effective. The injection of bacterins (bacterial vaccines) has proved useful in many instances in preventing the spread of an outbreak and protecting the unaffected portion of the flock, or herd.

- 926 - **The Susceptibility of Camels to Symptomatic Anthrax, Hemorrhagic Septicemia, and Rinderpest: Experiments Carried out in British India.** — CROSS, H. E., in *Agricultural Research Institute Pusa, Bulletin*, No. 50, 17 pp. + 1 fig. + 16 diag. Calcutta, 1919.

Although, from time to time, camels are said to have died of symptomatic anthrax, a well known cattle disease, yet there were no details to hand showing that it is a malady to which camels are liable.

In order to decide whether the malady is one to which camels are subject, the writer inoculated 3 of these animals of different ages with the virus of symptomatic anthrax, a buffalo and an ox being used as controls. The results of the experiment showed that camels contract the disease as readily as cattle.

In British India, hemorrhagic septicemia causes great losses among the cattle, but it was not known whether the disease attacked camels also. The writer has investigated the matter, and inoculated 2 camels with septicemia, using as controls, 2 calves and 2 rabbits. The experiment proved that camels are not very susceptible to this malady, and confirmed the results previously obtained by GAIGER.

Rinderpest epidemics have not been recorded as occurring among camels, but occasionally, some of these animals are said to have died of the disease. In order to see if rinderpest attacked camels, the writer inoculated 3 camels of different ages with the virus, using 2 calves as controls. This experiment showed that camels can suffer from severe lesions due to rinderpest, and are indeed more susceptible to the disease than some cattle. These conclusions tally with what VIEDORNIKOV PETROWSKY has said regarding the camels of the steppes.

- 927 - **Coccidiosis of the Goat in Morocco.** — VELU, H., in *Bulletin de la Société de Pathologie exotique*, Vol. XII, No. 6, pp. 298-301. Paris, June, 11, 1919.

Goat coccidiosis, was reported for the first time in 1905, by G. MAROTEL; little has, however, been written about it, and its pathogenetic rôle has not been clearly determined.

The writer had the opportunity of studying an epizootic outbreak of this disease among a herd of 82 Spanish goats (which had been imported to Casablanca) and their offspring, and he reports some interesting facts concerning the disease of which the parasitic agent is the microorganism described by MAROTEL under the name of *Eimeria Arloingi*.

The malady is exclusively one attacking very young sucking animals of only a few weeks old. Fifteen of these (25% of the whole number) died, after manifesting serious symptoms of illness, while 45 others, which also succumbed to the malady, showed no noticeable signs of serious indisposition.

The disease develops very rapidly. It manifests itself by progressive anaemia, with intestinal troubles, diarrhoea, great loss of flesh, and sometimes attacks of convulsions during the two or three days preceding death, which usually supervenes at the end of a week.

The lesions are very characteristic, and resemble those met with in intestinal coccidiosis in lambs. The writer never saw the cutaneous lesions described by STEVENSON and BALFOUR.

The penetration into the organism of the parasite producing the malady is not necessarily followed by intestinal disturbances; the infected animals can become mere disease-carriers.

Further, the investigations made on the advice of M. MONOD, the chief veterinary surgeon, have revealed the presence of *Eimeria Zurni*, and the fact of its latent parasitism among the cattle of Chaouia. The discovery of the latent parasitism of coccidiosis in the case of two different species of animals is interesting, as showing the possible part played by coccidiosis-carriers in spreading the disease. In the herd examined by the writer, the "presumably healthy" animals were disease-carriers and had infected the young ones.

He tried various methods of treating both the infected and the "presumably healthy" goats (chlorohydrate of emetine, and thymol), but without the least success. On the other hand the removal of the herd from the infected farm to entirely new sandy ground, situated near the sea, rapidly checked the course of the disease and enabled the adult animals to regain their usual health.

928 - *Anaplasma marginale*. - Dr DOMIZIO, G (Laboratorio di Patologia generale della R Università di Pavia), in *La Clinica veterinaria*, Nos 7-9, pp 203-220, 237-251, 292-311, 12 figures, bibliography of 57 publications. Milan, April-May, 1918

A practical examination of the literature dealing with the subject, and of the investigations and experiments carried out in Erythrea, and at the Laboratory of General Pathology of the University of Pavia. The writer deduces the following conclusions —

In Erythrea, the goats are subject to the attacks of an endoglobular parasite of the blood, which there is every reason to suppose belongs to a species of the genus *Anaplasma* (*A. ovis*).

The experiments and investigations that have been regarded by several writers as throwing doubt upon the parasitic nature of *Anaplasma*, which in their opinion, is a nuclear residuum (JOLLY's body), as well as those upon which they have based their belief that the said *Anaplasma* belongs to the cycle of some piroplasma, have hitherto not detracted from the value of the experiments of THEILER and LIGNIERES. These have revealed the presence of the parasite to which THEILER has given the name of *Anaplasma*.

From the morphological point of view, the most distinctive characters of *Anaplasma marginale* (and of the central variety) as well as those of *Anaplasma argentinum*, as described by THEILER and LIGNIERES, differ mainly from the JOLLY's bodies found in the blood of anaemic subjects, in the much large percentage of haematids with marginal points.

The most distinctive characters of the above-mentioned forms of *Anaplasma* differ also from those of anaplasmatic forms of piroplasma, in the larger percentage of haematids with marginal points, and in the perfectly rounded shape and distinct outline of each of these points.

Although the marginal points, on being examined one by one, present irregular and indistinct contours (like the anaplasmatic forms of *piroplasma*) yet certain characters described by some writers when taken together point to the parasite being a true *Anaplasma*.

Although hitherto *Anaplasma* has only been clearly identified on the cattle of South Africa and Argentina, nevertheless the researches and investigations of many scientists lead us to believe : a) that it also exists elsewhere, and occurs not only in cattle, but also in other animals ; b) that very probably there are several species, or varieties of *Anaplasma*, which are not only to be found in different species of animals, but also in the same species ; c) that there are some species, or varieties, which while they retain the morphological type of *Anaplasma*, yet present some slight differences of shape.

929 — **The Hog Louse, *Haematopinus suis* (Lin.) Leach.** — WATTS, H. R., in *Agricultural Experiment Station of the University of Tennessee, Bulletin No. 120*, 16 pp., 7 figs. Knoxville, Tenn., July, 1918.

This bulletin is a preliminary report and a popular account of the results of the investigations on the life-history and habits of the hog louse carried on at the Experiment Station at Knoxville.

These results are summarized as follows :—

The eggs, or " nits ", of the hog louse are glued to the base of the hairs, chiefly on the lower half of the body. The eggs are laid only on hogs.

The louse becomes full-grown and the female begins laying eggs in from 11 to 13 days after hatching. The female lays from 3 to 4 eggs a day. Only one egg is laid at a time. The eggs hatch in from 13 to 20 days, the majority on the 15th, 16th, and 17th days.

The louse normally lives about 30 days, but many lice are injured, killed, and lost from the host before that time. A few have been found to live more than 40 days, but this is exceptional.

The duration of the life-cycle is normally 29 to 40 days, but varies from 24 to 63 days and the number of generations is usually from 9 to 12 per year, but varies from 6 to 15.

The best remedy is the application of thin oil. Any oil, or any mixture containing considerable oil, will kill both lice and eggs.

Thick, heavy greases or pasty materials should not be used, as they do not spread over the skin well enough to be very effective, and are not economical.

Medicated oils, disinfectants, and various proprietary materials are no better than the common oils for killing hog lice, but may be just as good if they contain considerable oil and no substances that are injurious to the animals.

Poisonous substances should not be used, as they might poison the animals.

930 - A New Strongylid of the Domestic Pig. — BAILLET, A., HENRY, A., and BAUCHE, J., in *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 6, pp. 324-332, 5 figs. Paris, June, 1919.

At the present time, 3 species of strongylides are known as parasites of the domestic pig:—

1) *Characostomum longemucronatum* (MOLIN, 1861) or *Globocephalus longemucronatus* in the small intestine.

2) *Oesophagostomum dentatum* (RUD., 1803) in the caecum, colon, and sometimes the small intestine.

3) *Stephanurus dentatus* (DIESING, 1839) in the kidneys, liver, and abdominal cavity.

The writers introduce to our notice, and describe under the name of *Bourgelatia diducta*, a new form living in the intestine of swine; it is usually found in the large intestine, although it has also been met with in the small intestine.

This parasite was first found in Germany, and subsequently in Austria, Brazil, France, the Antilles, United States (2), Italy and Indochina.

It is whitish in colour, and often sinuous, from 20 to 24 times longer than broad, and attenuated towards the extremities; about the middle of the body, there are transverse striae on the cuticle which are situated from 5 to 7 μ apart. The length of the spicules seems to be very variable (from 0.90 mm. to 1 mm. or even 1.2 mm.).

According to BAILLET the eggs hatch out in water in 3 or 4 days. Larvac at different stages have been found by OLT, LIEBE and other writers, in nodules of the large intestine which were situated on solitary follicles, and showed signs of incipient ulceration.

931 - Observations and Experiments on Intestinal Trichinae (1). — SCHWARTZ, B. (Zoological Division, Bureau of Animal Industry, U S Dept Agr), in *Journal of Agricultural Research*, Vol. XV, No. 8, pp. 467-482, 3 figs. Washington, November 25, 1918.

Although *Trichinella spiralis* has been studied by many investigators, the literature on the subject is almost exclusively devoted to the morphology and life history of the parasites and their relation to the disease which they produce in man and in other mammals. Several investigators have recorded some casual observations on the physiology of these parasites, particularly with reference to the resistance of the encysted larvae to unfavorable conditions. No attempt has heretofore been made, however, to present a systematic account of the behaviour of these organisms under the influence of various physical and chemical stimuli at different stages of their life history. Recently, RANSOM, in the course of a report of an investigation on the effects of refrigeration on the encysted larvae of *T. spiralis* has presented some interesting data relative to their behaviour when

(1) See also R., Nov. 1918, No. 1258. (Ed.)

freed from their cysts by artificial digestion. RANSOM and the author have continued these investigations and have obtained a considerable amount of data on the resistance of the larvae to high temperatures and to various physical and chemical agents.

Inasmuch as little has been known heretofore concerning the physiological processes of the parasites concomitant with their growth in the small intestine, it appeared to the writer that observations and experiments on the intestinal forms, with special reference to their behaviour under various conditions, might yield some useful information. The present paper embodies the results of this work and also includes observations on the moulting of the larvae *in vitro*, a phenomenon which, so far as the writer is aware, has not been hitherto recorded.

The larvae of *T. spiralis* do not linger in the stomach of the host after are they freed from their capsules, but pass into the small intestine.

The passage of the larvae through the stomach does not stimulate them to further growth and development, and a brief sojourn in the intestine is insufficient to initiate those processes which lead to sexual maturity.

Larvae which have been stimulated to further development in the intestine will moult even after being removed from that organ. The moulting process may be hastened by high temperature and suppressed by low temperatures.

Larvae which have not yet been stimulated to further development in the small intestine can not be caused to moult by a high temperature.

With the beginning of development in the small intestine the larvae lose the power of surviving for considerable lengths of time outside of the host. They afterward become more persistent, however, in direct proportion to their increasing age.

When removed from the host within 24 hours after artificial infection, intestinal trichinae often undergo spontaneous disintegration which may be due to the sudden change of environment, lack of food, or possibly the liberation of toxic substance which affect the parasites while in an artificial medium.

After the first and subsequent moults the tolerance of the larva to various toxic agents is replaced by a marked sensitiveness to such agents which decreases, however, with advancing age.

Under the influence of potassium cyanide the worms undergo disintegration and exhibit susceptibility to the poison along the major axis, which in the growing forms appears to be greatest in regions where growth takes place most rapidly. Modifications in the permeability of the cuticle do not appear to be directly responsible for the changes in susceptibility. The changes probably result from a reorganisation of the protoplasm coincident with growth, differentiation, and age.

Attempts to induce moulting in the larvae which have been decapsuled by artificial digestion and afterwards kept *in vitro* under various conditions have thus far failed to yield successful results.

- 932 - **Notes on Swine Diphtheria.** — SCHMIEDROFFER, J. (École supérieure d'art vétérinaire de Budapest), in *Zeitschrift für Infektionskrankheiten, parasitären Krankheiten und Hygiene der Haustiere*. Vol. XIX, Part 4, pp. 345-366, 3 figs. + bibliography of 19 publications. Berlin, September, 1918.

In the writer's opinion the infectious disease which attacks pigs, and is known as swine diphtheria, owing to its symptoms being similar to those of diphtheria, should be regarded as a paratyphic infection, for the only pathogenetic micro-organisms he was able to discover in the infected animals (except *Bac. necrosis* which could have had nothing to do with the disease, as it was easy to prove) was *B. paratyphus* belonging to the *B. coli* group.

By means of pure cultures of this micro-organism, the writer was able to produce the characteristic symptoms of swine diphtheria in pigeons, guinea-pigs, and rabbits, hence he considers that the disease is undoubtedly due to *B. paratyphus*. At present, it is impossible to exclude the hypothesis that the malady in question may be a special form of swine paratyphus produced by the development of the microbe in the pharynx, instead of in the intestine. It is, however, very difficult to determine whether it is a question of a new and hitherto unknown species of micro-organism belonging to the *paratyphus B* group, or of a less virulent form of *Bac. suispestifer*.

In any case, the writer believes that the great annual losses due to diseases of paratyphic origin, could be lessened by the use of a polyvalent vaccine, prepared in the same manner as the antityphus and anticholera vaccines employed during the war.

This polyvalent vaccine would at the same time inhibit the action of *Bac. suispestifer*, the most dangerous of the micro-organisms belonging to the paratyphic group.

- 933 - **Important Poultry Diseases** (1). — SALMON, D. E. (revised with additions by GALLAGHER, B. A., the sections on parasites revised by POSTER W. D., in *U. S. Department of Agriculture, Bulletin* 957, 48 pp. + 11 figs. Washington, March, 1918.

In this Bulletin, the causes, symptoms and treatment of each of the diseases are described. The following diseases are dealt with:— Contagious catarrh (croup) (pathogenetic agent unknown); fowl diphtheria (virus filterable and invisible); bird or chicken pox (virus filterable, same as that of diphtheria); fowl cholera (*Bacterium avisepticum* and diseases of cholera-like nature (bacilli or *Bacillus coli* group); fowl typhoid (*Bact. sanguinarum*); white diarrhoea of chicks (caused by at least four different kinds of infection: *Bact. pullorum*, *Bact. avisepticum*, coccidia, *Aspergillus*); infection of *Bact. pullorum* confined to the ovary; Coccidiosis; brooder pneumonia or Aspergillosis (*Aspergillus fumigatus*); tuberculosis; entero-hepatitis (*Amoeba meleagridis*); gout (abnormal quantity of uric acid on the blood); gapes (*Syngamus trachealis*); intestinal worms (*Ascaridia perspicillum*, *Heterakis papillosa*, *Davainea echinobothridia*, etc.); favus, white comb (*Lophophyton gallinae*); lice; mites (*Dermanyssus gal-*

(1) See also *R. Dec.* No. 1313; *R. Sept.* 1917, No. 830; *R. Jan.* 1918, No. 61; *R. Feb.* 1918, No. 180; *R. March* 1918, No. 438; *R. July* 1918, Nos. 779 and 780; *R. Aug.* 1918, No. 789; *R. April* 1919, No. 495. (Ed.)

linae, etc.; depluming scabies; scaly leg; ticks (*Argas miniatus*, etc.); cropbound, or impacted crop; inflammation of stomach, or intestines; limberneck, paralysis of the neck muscles (a symptom of many diseases).

**FEEDS
D FEEDING**

934 — **Investigations on Digestion in Cattle, in the United States.** — I. EWING, P. V. and WELLS, C. A., The Associative Digestibility of Maize Silage, Cottonseed Meal and Starch in Steer Rations, in *Georgia Agricultural Experiment Station, Bulletin* No. 115, pp. 269-295, 7 fig. 1915 summarised in *Experimental Station Record*, Vol. XXXIV, No. 2, pp. 169-170, Washington, Febr. 1916. — II. EWING, P. V., WELLS, C. A. and SMITH, P. H., The Associative Digestibility of Maize Silage and Cottonseed Meal in Steer Rations, *Ibid.*, No. 125, pp. 145-161, 1 fig. 1917, summarised in *Experimental Station Record*, Vol. 37, No. 21, pp. 65-66, Washington, July, 1917. — III. EWING, P. V. and SMITH, P. H., Digestibility of Maize Silage, Velvet Bean Meal and Alfalfa Hay when fed singly and in Combination, in *Journal of Agricultural Research*, Vol. XIII, No. 12, p. 611-618, Washington, June 17 1918. — IV. EWING, P. V. and SMITH, P. H., A Study of the Rate of Passage of Feed Residues through the Steer and its Influence on Digestion Coefficients, *Ibid.*, Vol. X, No. 2, pp. 55-63, 1917. — V. EWING, P. V. and SMITH, P. H., A Study of the Physical Changes in Feed Residues which take place in Cattle during Digestion, *Ibid.*, Vol. XIII, No. 12, pp. 639-646, 1918.

I. — **MAIZE SILAGE, COTTONSEED MEAL, AND MAIZE STARCH FED TO STEERS: INFLUENCE OF ONE INGREDIENT OF A RATION ON THE DIGESTIBILITY OF OTHER INGREDIENTS.** — Investigations made at the Georgia Agricultural Station with the object of determining this influence. Studies were made on nine distinct rations composed of the above mentioned foods compounded, not by weight, but according to percentages of net thermal energy values, that is to say the 3 ingredients (in the order noted above), had the following proportions in the nine rations:

100:0:0 — 0:100:0 — 10:30:0 — 50:50:0 — 34.5:34.5:31 — 69:0:31 — 30:70:0 — 15.8:36.9:47.3 — 52.7:0:47.3.

Yearling Shorthorn steers were used and the digestion trials were of 10 days duration each with some days interval between trials.

Results. — Starch when fed in excessive quantity diminished the digestibility of the nitrogen and crude fibre, even when the excess was not great. When 47.3 % of the net thermal energy of the ration was supplied in the form of starch, there was also a reduction in the digestibility of the total mineral matter.

The reductions in the digestibility of nitrogen, crude fibre and mineral matter were accompanied by an increase in the digestibility of fat, particularly noticeable in the high starch rations.

The reduction in the digestibility of the nutrients caused by the excess of starch was prevented to a great extent, sometimes even completely, by the addition of cottonseed meal, even when the total quantity of starch in the ration remained constant.

Increase in the quantity of crude fibre in the ration did not diminish the digestibility of the nitrogen-free extract, but rather tended to increase it.

The variability of the results given by different steers, due either to the individuality of the animals, or to imperfections in the usual methods of conducting metabolism experiments, was so great as to obscure, in some cases, the variations resulting from the food combinations. The nearer the ration approached what is generally considered a normal one

(such as 70 % of the net thermal energy supplied in the form of maize silage and 30 % in the form of cottonseed meal), the smaller were the individual variations.

When steers are changed from one ration to another, they do not at first secure all the nutriment from a new ration which they will secure after they become accustomed to it, and this is especially the case when a poor ration is succeeded by a rich one. Even when as much as 47.3 % of the net thermal energy of the ration was supplied in the form of starch, the iodine test did not indicate the presence of starch in the faeces.

Within certain limits, the total quantity of nitrogen excreted in the faeces was fairly constant, in spite of market changes in the quantity of nitrogen fed and digested. A steer, weighing 200 kg., excreted in the faeces as much as 5.84 gm of nitrogen per day for a period of 25 days.

For rations of maize silage + cottonseed meal the calculated coefficients of digestion when compared with the coefficients found by experiment are found to be fairly approximate. For dry matter the difference was not greater than 5 %; for nitrogen, 7 %; for crude fibre, 10 %; for fat, 14 % and for mineral matter 30 %.

In the case of rations of maize silage + cottonseed meal modified by the addition of starch the calculated coefficients of digestion were much less approximate to the actual coefficients found by experiment: the difference was as much as 15 % for nitrogen-free extract; 20 % for dry matter; 35 % for mineral matter; 45 % for crude fibre; 55 % for fat; and 73 % for nitrogen.

II. MAIZE SILAGE (WITHOUT EARS) AND COTTONSEED MEAL, FED TO STEERS: INFLUENCE OF ONE INGREDIENT OF A RATION ON THE DIGESTIBILITY OF THE NUTRIENTS OF THE OTHER INGREDIENT. — For these experiments, carried out also at the Georgia Agricultural Station, two year old Shorthorn steers were used, and were fed with 6 different rations: — 2 of maize silage alone; 2 of maize silage + cottonseed meal; 2 of cottonseed meal alone. Of the last, only one gave satisfactory digestive results.

Results. — In general, the combination of the two foods used did not produce any appreciable difference in the digestibility of nitrogen and of fat.

When maize silage and cottonseed meal were combined in the proportion 3.4 : 1, the coefficient of digestibility for the total dry matter was 4.62 % below the theoretical coefficient. On the other hand, when these two foods were combined in the proportion 7.7 : 1, the coefficient for the dry matter exceeded the theoretical coefficient by 1.1 %.

In the two rations in which the two foods were combined, there was an appreciable gain in the digestibility of mineral matter and nitrogen-free extract, but on the other hand, an appreciable reduction in the digestibility of crude fibre.

With a view to determining the causes of these gains and losses of digestibility, the authors, by a method devised by them, divided the faeces into 3 constituent parts, one of them being assumed to represent the undigested residue of maize silage; examining these three parts they came to the conclusion that a steer macerates his food approximately 4 times

as well when fed with maize silage alone as when fed with maize silage + cottonseed meal in the proportion 3.4 : 1, and twice as well as when fed with the ration of maize silage + cottonseed meal in the proportion 7.7 : 1. The digestibility of the dry matter and crude fibre seemed to be proportional to the completeness of maceration or physical disintegration.

Feeding with maize silage + cottonseed meal seemed to increase the digestibility of total mineral matter in the cottonseed meal.

Conclusions. — Feeding with heavy cottonseed meal rations tends to reduce the nutritive value of the maize silage fed with it, so that the most economically used rations are those containing the maximum amount of maize silage and the minimum amount of cottonseed meal. The nutrients of cottonseed meal and of maize silage are not digested in the same proportions when fed alone and in combination.

III. COMPARATIVE DIGESTIBILITY OF MAIZE SILAGE, VELVET-BEAN MEAL, AND ALFALFA HAY WHEN FED SEPARATELY OR IN COMBINATIONS. — The 3 foods tried had the following composition : —

	Dry matter	Nitrogen	Ether extract	Crude fibre	Mineral matter	Nitrogen-free extract
Maize silage	26.29%	0.252%	0.773%	7.304%	1.180%	15.460%
Velvet-bean meal	89.37 "	2.764 "	4.576 "	14.430 "	4.250 "	48.840 "
Alfalfa hay	91.02 "	2.564 "	2.675 "	30.770 "	6.865 "	34.680 "

The steers used were 2 year old Shorthorns to whom 9 different rations were fed. — 3 were composed of each of the foods used separately ; 3 were composed of mixtures of two foods each ; 3 were composed of mixtures of all three foods in different proportions. The digestion trials were made in triplicate and lasted 12 days each. The following table shows the average coefficients of digestibility for the 3 foods used separately and in combination —

Rations		Dry matter	Nitrogen	Ether extract	Crude fibre	Mineral matter	Nitrogen-free extract
Maize Silage	Alone	69.02	35.00	74.10	77.57	25.96	71.37
	+ Alfalfa hay . . .	60.33	23.75	42.04	80.52	15.82	58.49
	+ Velvet-bean meal .	59.33	17.78	80.39	64.74	48.95	62.44
	+ Alfalfa + bean . .	56.58	19.07	81.21	55.45	15.06	64.18
Velvet-bean meal	Alone	83.91	75.95	76.04	78.95	56.36	90.62
	+ Maize Silage . . .	77.42	71.11	78.51	64.03	65.36	84.67
	+ Alfalfa hay . . .	79.52	75.17	75.48	63.03	67.46	86.98
	+ Maize + Alfalfa .	74.17	72.25	77.63	50.96	44.48	82.95
Alfalfa hay	Alone	62.79	69.56	41.91	57.99	45.83	69.55
	+ Maize Silage . . .	61.85	66.94	32.03	58.21	42.37	64.52
	+ Velvet-bean meal .	58.75	68.44	45.82	50.67	52.07	64.86
	+ Maize + bean . . .	53.67	65.06	33.26	42.25	39.11	60.66

Conclusions. — The combination of the above mentioned foods tends, generally, towards lowering the digestibility of the several nutrients of the rations.

The digestibility of each of the 3 foods appears to be fairly constant under the different combinations.

More accurate digestion coefficients are obtained by feeding-alone experiments, where such are possible, rather than by the usual difference method.

There were greater variations in the digestibility of nitrogen and mineral matter than in the other nutrients.

Compared with similar food, velvet-bean meal was well digested.

IV. RATE OF PASSAGE OF FOOD RESIDUES THROUGH THE DIGESTIVE ORGANS OF THE STEER AND ITS INFLUENCE ON DIGESTION COEFFICIENTS. — Research carried out at the Georgia agricultural Station with the object of —

(1) Determining, by means of digestion trials, the relation between the moisture content of the faeces and the digestion coefficients to see whether there is any correlation between that moisture content and the time required for the passage of food residues through the digestive organs.

(2) Determining more directly and more exactly, by means of rubber "markers", the time required for the passage of food residues through the digestive organs.

(3) Determining the rate of this passage by means of calculations based upon the time of feeding, the time of expulsion of the faeces, and the contents of the different digestive organs examined after slaughtering.

(1) To avoid complications in the calculations and results which would arise if comparisons were made of data obtained with different rations, the correlations between high and low moisture contents of the faeces and the corresponding digestion coefficients were investigated on identical rations. Two series of digestibility trials were made, both in duplicate, and the correlations obtained show that with a higher moisture content of the faeces (arising from abundant secretion of digestive juices) there is more complete digestion of all nutrients except nitrogen and fat.

On the assumption that a high moisture content of the faeces indicates a rapid rate of passage of food through the digestive organs it follows that digestion is probably more complete, for all nutrients, when the passage is faster, and less complete when the passage is slower. However this method only indicates the correlations which exist and not the values of the difference in digestion caused by a high moisture content.

(2) At the commencement of digestibility trials, lasting 10 days, the steers were made to swallow disks of rubber cut from strong tubing and the time at which these "markers" appeared in the faeces was noted. Some were expelled in 12 hours, other took much longer to pass (as long as 60 days), while some were not found until the animals were slaughtered. This method was therefore impractical and, besides, examination after slaughter showed that hard particles of food and foreign substances were

specially prone to become delayed either in the reticulum, or in the fourth stomach, or in the first ventral folds of the duodenum. Coarse food retards the passage of food residues, as has been conclusively proved by examination after slaughter. In applying this method it was noted that the administration of 60 to 120 gm. of carbonate of lime or sulphate of magnesia per steer per day had no appreciable effect on the rate of passage of food residues or on digestion coefficients.

(3) An exact measure of the time required for the passage of feed residues was obtained by means of the formula $T = \frac{C}{R - F}$ in which T represents time units required for the passage of food residue, C the quantity of dry matter contained in the digestive organs of the steer at the time of slaughter; R the dry matter content of the ration per given unit of time; F the dry matter content of the faeces expelled during that unit of time.

The author recognises the want of accuracy of the method due to certain metabolic processes, but he shows that their influence on the results would not, at most, be greater than their influence on the digestion coefficients.

The data obtained with this method show that for the rations used and the quantities fed, the time required for the passage of food residues through the digestive organs of steers varied from 72 to 84 hours.

The two most important factors in determining the rate of this passage are the nature of the ration and the amount fed. Thus coarse food seems to require much longer time than concentrated finely-divided food. As regards quantity, in the case of coarse food, it seems that the smaller the quantity the longer the time required for the passage of the food residues, while for concentrated ground foods the difference was less marked.

The author does not consider it possible definitely to attribute changes in the digestion coefficients to the rate of passage of food residues through the digestive organs. The most that can be said is that when the rate of passage increased there was an apparent increase in the digestibility of mineral matter, negligible results for nitrogen, a distinct decrease in the digestibility of crude fibre, an increase in the digestibility of nitrogen-free extract, and negligible results for fat.

V. PHYSICAL CHANGES IN FEED RESIDUES DURING DIGESTION. — These changes were studied in relation to the several digestive organs and different steps in digestion rather than the process of digestion as a whole.

As foods, chopped maize silage (without ears) and cottonseed meal were used; of the former only the portion which would not pass through a 2mm. screen was taken; of the latter only the finest parts which had passed successively through screens 1.7 mm. and 1.3 mm mesh were used. The two foods thus prepared had the following percentage composition: —

	Dry matter	Nitrogen	Fat	Crude fibre	Mineral matter	Nitrogen-free extract
Maize silage	25.65	0.157	0.43	9.82	1.62	12.80
Cottonseed meal	90.12	6.220	7.73	5.70	5.57	32.24

When the rations were of maize silage alone the extent of comminution (below 2 mm) before the chyme left the rumen and the reticulum was 65.8% in the smaller ration and 58.5 % in the larger ration.

When 60 % and 40 % of cottonseed meal were added to these two rations the extent of comminution increased by 5.1 % and 10.5 %.

The extent of comminution in the omasum varied between 6.3 % and 18.6 %, being greater in the rations of maize silage + cottonseed meal and less in the rations of maize silage alone. The extent of comminution in the abomasum varied between 5.3 % and 11.2 %, being greater in the rations of maize silage alone.

The extent of comminution was much less in the small intestine and in the large intestine than in the preceding phases of digestion and is more or less hidden by absorption.

On the average for all rations fed the time required for the passage of food residues through the digestive organs was: — 61.07 hours in the rumen and reticulum, 7.88 hours in the omasum, 2.83 hours in the abomasum, 6.72 hours in the small intestine, and 7.58 in the large intestine.

935 - Digestibility of Mustard Flour and Mustard cake; Research in Sweden. —

GUDRUN WEIBULL (Alnarps Kemiska Laboratorium), in *Kungl. Landbruks-Akademiens Handlingar och Tidskrift*, Year 58, No. 2, pp. 123-124, 1 tabl. Linköping, 1919.

Mustard flour and mustard cake vary in colour from light to dark shades according to the different processes by which they are manufactured. The author has determined the digestion coefficients and the digestible albuminoid contents for various samples of mustard flour and mustard cake by using STUTZER's method of artificial digestion (pepsin and hydrochloric acid); he also gives the digestion coefficient and the digestible albuminoid content of mustard seed in the natural state as well as those of rape seed and rape cake for comparative purposes.

The following are the data obtained respectively for the digestible albuminoid content and for the digestion coefficient:— Mustard seed, 20.6 % and 87.8; mustard cake, very light colour, 27.6 % and 87.5; darker cake, 28.6 % and 86.2; mustard flour, very light colour, 27.2 % and 85.9; flour, light colour, 31.9 % and 80.1; flour, dark colour, 22.2 % and 66.6; flour, very dark colour, 18.2 % and 61; rape cake, 23.3 % and 83.0; rape colza seed, 13.8 % and 81. It is seen that the digestion coefficient of mustard cake is near 87 which is that for mustard seed in the natural state and which is higher than that for rape seed and rape cake (averaging 82). The digestion coefficient for mustard flour on the other hand varies considerably from 61 to 86; the darker the colour of the flour the smaller is its digestible albuminoid content. It appears from

these investigations that the digestibility of the various samples depends on the method of manufacture and that the nutrient value is much reduced if the product has been subjected to a high temperature; this is why the digestible albuminoid content is higher in mustard cake than in mustard flour, the cake not having been subjected to so high a temperature.

It is therefore necessary to take this fact into consideration both in purchasing these products and in calculating the ration so as to avoid error in the calculation of the albuminoid content, which, in good samples, should average about 27 %.

This also explains why feeding mustard seed (flour or cake) has given a smaller yield of milk than that obtained by feeding with groundnut cake or herring meal.

1931 - **Hydrolysis of Maize Stalks with the Object of Transforming them into a More Digestible Food.** — SCURTI, I. and MORRELLI, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. I, II, Part 5-6, pp. 238-365. Modena, 1919.

The authors have experimented with woody substances, waste or rejected matter, with the object of trying to transform them into compounds easily assimilated by animals. The present note sums up the investigations made with maize stalks and contains a full summary of the present state of knowledge relating to the chemistry of wood and the capability of assimilating cellulose and its combinations. The materials experimented with, crushed, finely ground and dried at a temperature of 100°C., had the following percentage composition: --- Fat (ether extract) 0.52; crude protein ($N \times 6.25$) 1.75; cellulose 38.60; ash 2.11; nitrogen-free extract 57.02 (pentosans 15.81); organic matter soluble in water 5.60; organic matter soluble in dilute hydrochloric acid 46.30 %.

Acting for two hours at a temperature of 130°C. on 1 part by weight of dry stalk meal + 10 parts of water + 0.05 to 0.45 parts of caustic soda, it was noted that the soda acting under these conditions on the stalk meal was able to separate the woody combinations, but only partially; the undissolved residue still contained notable quantities of hemicellulose. The components dissolved by the action of soda changed into resinous substances, so that the alkaline solutions only contained traces of sugars.

Acting for two hours at a temperature of 130°C. on 1 part by weight of dry maize stalk meal + 10 parts of water + 0.0125 to 0.25 parts of sulphuric acid, it was found that sulphuric acid is more active than caustic soda as a catalytic agent of hydrolytic division of the woody substance of maize stalks. In fact while, by adding 45 % of alkali, a product containing only 69.65 % of cellulose and in a proportion of 41 % of the crude material used was obtained, the addition of 15 % of sulphuric acid sufficed to produce a residue containing 74.30 % of cellulose, or a proportion of 47.12 % if the material used. Moreover, when using the alkali no sugars were obtained owing to changes caused by the soda, but when using sulphuric acid 32.96 to 47.50 % of sugars were obtained.

Separation is best effected by using about 4 % of sulphuric acid com-

pared with the material to be acted on and by maintaining a proportion of $\frac{1}{10}$ between this material and the water used. A reduction in the proportion of water, even if accompanied by a reduction of the acid, hinders the process of hydrolysis. Experiments with 4 % of sulphuric acid at a temperature of 130° C. were carried out under a pressure of 1 to 2 atmospheres; the authors have tried whether hydrolysis could also take place using less acid but raising the pressure (5 to 10 atmospheres), with negative results.

In the mixture 1 part of stalk meal + 10 of water + 4 of sulphuric acid heated to 130°C., whether the heating is limited to 1 hour or whether it is prolonged for over 2 hours, there is a sensible decrease in the sugars; in the former case there is complete hydrolysis, in the latter a commencement of change in the sugars.

By boiling at 130°C. for 2 hours, 1 part of stalk meal + 5 parts of water + 0.50 to 3.73 parts of hydrochloric or nitric acid, it was noted that hydrochloric acid is also a good catalyser, but less active than sulphuric acid, and that nitric acid has more effect than hydrochloric acid but less than sulphuric acid; and as the products so obtained are about equally coloured there is no advantage in using another acid in place of sulphuric acid.

CONCLUSIONS. — The woody matter in maize stalks is separated under acid hydrolysis and pressure into cellulose and hemicellulose; the latter, under the action of subsequent hydrolysis, gives a mixture of sugars among which can be recognised glucose, arabinose, and xylose. The above mentioned process, then, changes woody component into reducing sugars and free cellulose. Assuming that, in these conditions, cellulose freed from ethereal compounds is assimilable (at any rate by herbivorous animals) as starch, it follows that two components of great value as animal food are derived from an almost indigestible woody substance.

The yield is almost quantitative since 60 lb. of free cellulose and nearly 40 lb. of saccharine components are obtained from 100 lb. of dry stalk meal.

937 — **Food Value of Couch grass; Research in Sweden.** — WEIBULL, M., in *Landmannen Tidskrift för Landtman*, Year 1, No. 17, p. 281. Stockholm, April 1918.

The author had the opportunity of analysing some samples of dried, crushed couch-grass and obtained the following data (percentages): — Protein 8.3; fat 1.2; nitrogen-free extract 62; cellulose 16.5; ash 5; water 7. It is evident that, in a time of scarcity, couch-grass can be used as cattle food; its nutrient value is nearly the same as that of hay, from which, however, it differs by its smaller cellulose content, which is rather advantageous. The nutrient value of couch-grass has already been recognised in other countries: according to PORR, couch-grass is often used, in Normandy, in place of oats in horses' rations; animals eat it eagerly with good results. Although the protein and fat contents of couch-grass are smaller than those of oats, couch-grass contains the same glucoside

as oats, that is to say coniferin, which in the animal organism serves in the synthesis of vanillin. The author adds that couch-grass is specially suitable for horses and sheep.

938 - **Rational Utilisation of Bones by Pulverising.** — HAMEL, GEO T., in *L'Industrie française de la Conserve*, Year V, No. 28, pp. 162-164. Paris 1, June 1919.

As human flesh-food bones are wasted or used in making broth. But in making broth whole bones yield but a fraction of their gelatin, fat and salts, and all the rest of the assimilable elements of the bone tissue is lost.

The author recommends that bones should be crushed at home or by the butcher. Broth made with roughly pulverised bones would be much richer. It would be still richer if made in an autoclave. The residue of the bone powder after making soup, dried in the sun or in the oven, could be fed to animals either as it stood (for poultry), or mixed with other foods (for young pigs and dogs it must first be sifted to remove splinters of bone which might otherwise injure the mucous membrane of the digestive organs).

The addition of bone powder to the food of young animals helps the development and prevents diseases, caused by deranged nutrition, which sometimes appear consequent on food containing insufficient nitrogen or containing too little mineral salts. Bone powder seems to increase the laying power of poultry. It must be of good quality, that is to say made of fresh bones and used as soon as possible after it has been done with in the kitchen.

939 - **Research as to the Nature of Telegony.** — *Comptes rendus des Séances de la Société de Biologie*, Vol. I,XXXII, No. 23, pp. 883-884. Paris, July 19, 1919.

The body of observations invoked for and against the theory of telegony is not sufficiently known. It must be allowed that certain related facts are evidence some for, and others against telegony in so far as it is an apparent phenomenon. These facts, however, tell us nothing on the subject of the nature of the phenomenon. Further, nothing is known of the genetic constitution of the animals on which the observations were made.

In order to investigate the inmost nature of the phenomenon, the author made a series of experiments the results of which he briefly sets forth.

The problem to be solved was stated as follows: — "Can the genetic constitution of a female, consequent on fertilisation by a male phenotypically and genotypically different be influenced in such a manner that it constitutes in fact a new genetic constitution?" To remove as far as possible erroneous causes the author worked on the colour of rabbit fur, the mendelian factors of which are well known. Numerous preliminary experiments had, also, assured him of the presence of the factors in question.

A pure black doe rabbit was mated with a blue agouti buck (slate blue with white belly). The author used a blue agouti as male parent because he brought two types of factors into play by doing so, one active,

the factor agouti G, and the other passive, the absence of the factor of intensity D, which transforms blue into black.

In order to prove whether the black doe was influenced by the blue agouti buck, or by its products, this doe was next mated with an albino buck. The latter not being coloured, this was the best way of accentuating the eventual modifications caused in the genetic constitution of the doe. The mating of the black doe with the albino buck gave, in 2 litters, 10 young ones all black agouti (wild).

At first sight this result might be considered telegony. The young wild synthetic black + blue agouti seem to have influenced the mother by the addition of a double dose of the agouti factor. It was not so, however. As a matter of fact, on investigation it was found that the albino buck had for genetic constitution $B_2 C_2 DG_2$, that is to say that he was a wild albino with a single dose of the factor intensity of colour, D. The synthetic of black + wild albino should give wild rabbits. Nevertheless, as the albino buck had a single dose of D there ought to have been some blue agouti young in case of disappearance of the factor D in the black doe. This was not the case. It was, however, necessary to ascertain whether the 4 successive litters of wild young ones had not caused a modification of the genetic constitution of the black doe by introducing an agouti factor. To determine this point, the black doe was now mated with a chocolate brown buck. She produced, in 2 litters, 6 black young rabbits. This shows that the doe had not been influenced and that her genetic constitution had remained unchanged.

The apparent telegony was due to two concordant and accidental syntheses of genetic constitutions producing the same type. When facts which seem to relate to telegony come to notice, it is necessary to ascertain whether the cause of the phenomenon is not the accidental formation of genetic constitutions producing the same phenotype. It is more than likely that the resemblance of the young of the same mother bred by two different fathers may be explained in this way in every case.

940 - The Possibility of Distinguishing Sex by Examination of the Egg. — See No 959 of this Review.

941 - **Horses in the Great War: Lessons and Aims.** — JANINI, R. J., *Los caballos en la gran guerra, Enseñanzas y orientaciones*, 20 pp, 10 fig., Valencia, Publ. Hijos de Francisco Vives Mora, 1919.

HORSES

The data on which the author bases his work were chiefly derived from first hand information, verbal or written; the remainder were gathered from publications on this subject. The lessons of the war regarding horse breeding confirm the prediction of competent persons in recent years, namely that very great importance should be attached to hardiness, strength and fitness, in breeding horses for cavalry and artillery as well as for agricultural and draught purposes.

The English thorough-bred in spite of its great qualities possessed, as a war horse, grave defects of extreme nervousness and great requirements

in the way of food and care, defects which had previously been deplored in the Crimean war.

Anglo-norman trotters, as several authorities, amongst others M. DE GASTÉ, had predicted, were neither suitable for cavalry nor artillery.

The heavy Percheron and the Boulonnais have proved particular over food and little fitted for rough camp life; they lacked frugality, nerve and hardiness. Breeding has deteriorated these races of large and stoutly built animals by reducing the arab blood in them and has transformed them into expensive and less efficient draught horses. The same is the case with heavy English breeds of horses.

The best riding horses, as numerous French horse breeders, among them the Comte de COMMINGES, had foreseen, were anglo-arabs of the south of France; the hardy Camargue horses have also rendered excellent service.

As light draught horses, the little Ardennes and especially the little Breton horses, trained in a hardy manner, that is to say as working horses, have given excellent results; all these enduring, hardy, courageous and docile horses have arab blood in them. The horses which have proved the best draught animals have been the small ones measuring 1.47—1.48 m. in height at the withers. Horses 1.38 m. in height have also been excellent for draught purposes.

Breton cross-breeds and all crosses with much thoroughbred blood have not distinguished themselves either as saddle or as draught horses. The Comte de ROBIEU has complained of Norfolk-Breton horses as wanting in hardiness and docility. The qualities of small horses as draught animals are confirmed by the fact that the British Government has recently purchased in France medium sized Percheron mares to give a new direction to the breeding of draught horses in England.

Information relating to Canadian and Argentine horses are contradictory. According to some people Canadian horses have good qualities, but are extremely nervous. Argentine horses have confirmed their fame for hardiness and American horses have turned out well.

Barbs and mules have rendered excellent services; numerous data prove that Spanish horses and Barbs form a single breed. Modern war has relegated the saddle horse to a secondary position; in France, for example, before the great war, cavalry took 70 % of the army horses; at the present time the proportion is 8 %, while 92 % are draught horses (artillery, staff, engineers, infantry; the latter requiring about 300 horses per regiment).

The author applies this information to the direction which horse breeding for artillery ought to take in Spain; it should proceed on the same lines as that for agricultural horses. He shows that Spain possesses excellent stock for such breeding. In fact, the whole peninsula has a stock of horses in which, under more or less ugly shapes, great qualities of strength, hardiness, and docility are hidden, due in a large measure to the prevalence of Libian blood which has flowed in their veins since very ancient times, and, as Prof. RIDGEWAY has shown, it is entirely to Libian blood that Arabia owes its famous horses.

942 - **Horned Horses.** — JANINI, R. J., *A proposito de los caballos españoles con cuernos* 50 pp., 30 fig. Valencia, Publ. Hijos de Francisco Vives Mora, 1919.

The presence of rudimentary horns has been noted by DARWIN, PERCIVAL, AZARA, LYDEKKER and other authors in South American, English, Transylvanian and Spanish horses. PERCIVAL has described a case where the horns, situated about 5 cm. above the eye-sockets, measured, one 125 mm. and the other 187 mm. in length; AZARA has described 2 cases observed in South America, in which the horns were 75 to 100 mm. in length. The cases observed by LYDEKKER were in English thoroughbred horses. The author observed rudimentary horns, a few millimetres in length, in some Andalusian horses with a little Arab blood, as proved by the straight or slightly concave profile of the head. According to him, the presence of horns, or rudimentary horns, is characteristic of Arab horses; it reveals therefore a more or less distant cross with that race, and, consequently, strength and hardiness in the animal, often accompanied by great beauty in shape, as was the case with some of the horses which he studied and described.

943 - **Horse Breeding in Italy.** — ARA, A., in *Il Coltivatore*, Year 65, No. 15-16, pp. 326-328 Casale Monferrato, May 30-June 15, 1919.

Apart from racehorses and hunters and, in general terms, pleasure horses, ordinary horses can be divided into 3 classes: (1) slow heavy draught; (2) quick medium or heavy draught; (3) light draught or riding.

The first class is produced in the horse breeding zone of upper-Italy (especially in the provinces of Brescia, Cremona and Mantua) by local mares served by Belgian or rather Brabant stallions and some also by Shire, Clydesdale, or by Suffolk stallions. These very large horses weigh 8 or 9 quintals and measure 1.62 m. to 1.68 m. in height at the withers, but they are not strong and are easily tired; those which were requisitioned for the war had soon to be replaced or sent to the rear. It follows that horses of that size are useful for agricultural work and for heavy draught purposes in the country and in towns, but they are useless for artillery and army purposes in general (1).

In the horse breeding zone of Central Italy (Tuscany, Umbria, Marches, Latium and Abruzzi), the horses bred are medium draught or wheelers, out of country mares served by Ardennes, Percheron, Norfolk-Breton or Hackney stallions; their good conformation and their strength make them very suitable for use with field artillery, engineers and for heavy cavalry, as well as for quick commercial transport. Horses of this type are also bred in large numbers in the horse breeding region of upper Italy. These horses, being in greatest demand, are the most profitable to breed. Their height is from 1.55 — 1.60^m; weight from 500 to 550 kg. (2); they are robust, well formed; their legs are sound and combine strength and slighthness with good paces.

(1) See No. 941 of this *Review* (Ed.).

(2) The best return of draught horses is precisely that given by animals of 500 kg. live weight. (Author's note)

In the southern zone, including Sicily and Sardinia, light draught horses and a large number of riding horses are bred; Sardinia produces almost exclusively saddle horses. The horses of this zone are the produce of indigenous mares and thoroughbred or halfbred English and eastern stallions or mixed Anglo-oriental, and a few Hackney and Norfolk-Breton sires. They are very useful for field artillery and still more so for light cavalry.

CATTLE

944 - **A Study of the Birth Weight of Calves.** — ECKLES, C. H. (Department of Dairy Husbandry, University of Missouri), in *Journal of Dairy Science*, Vol. II, No. 3, pp. 159-169, Baltimore, May, 1919

A limited amount of data on this subject has been reported by Beach, Henry and Morrison, and Eckles. The new data in this paper were taken under the supervision of the author during a period of twelve years from the dairy herd owned by the University of Missouri. The animals included were all pure bred and registered. The Holsteins and Ayrshires represented lines of breeding common in prominent herds and are considered to be entirely typical of the breeds. The Jersey were of the line of breeding generally known as the American type, although some of the younger animals represent one-fourth or one-half of the blood of those lines of breeding known as the Island Type. The dairy Shorthorns were registered Shorthorns and represent the extreme dairy type of this breed. The lines of breeding represented, however, are among those used in the very best known herds of this breed.

RELATION OF BREED AND SEX TO BIRTH WEIGHT. — The most important factor influencing the weight of the calf at birth is that of breed. Table I gives the data on this point.

TABLE I.

Birth weight of calves, University of Missouri herd.

Breed	Average of both sexes		Males		Females		Weight of calf in proportion to dam
	Number	Average weight	Number	Average weight	Number	Average weight	
		lb		lb		lb	
Jersey . . .	196	55	102	58	94	53	6.5 %
Holstein . . .	154	90	69	93	85	88	8.0
Ayrshire	53	69	27	73	26	65	6.9
Dairy Shorthorn .	30	73	11	74	19	73	6.0

Table II is a combination of all data available for dairy breeds including those presented in this paper and those summarized by HENRY and MORRISON.

TABLE II.

Birth weights of the dairy breeds (all available data).

Breeds	Number of calves	Average weight both sexes	Average weight of dams
		lb	lb.
Jersey .	253	55	867
Holstein	229	89	1 137
Guernsey .	57	71	996
Ayrshire	80	72	983
Brown Swiss	5	100	1 123
Dairy Shorthorn	30	73	1 216

RELATION OF AGE OF DAM. — Table III gives the data for the Jersey and Holstein breeds arranged to show the average weight of calves in relation to the age of the dam. The dams averaged close on twenty-nine months of age at the time of birth of the first calf. The intervals between the birth of successive calves in the herd from which the data are taken average about thirteen months.

TABLE III.

Influence of age of dam upon weight of calf at birth.

Number of calf	Jerseys		Holsteins	
	Number of calves included	Average weight lb.	Number of calves included	Average weight lb.
First	44	51	45	85
Second	35	55	31	88
Third	35	58	26	95
Fourth	18	62	19	93
Fifth	13	58	10	101
Sixth .	16	52	5	90
Seventh	14	56	7	103
Eighth	8	56	7	98
Ninth	4	53	5	85
Tenth .	3	64	2	89
Eleventh	3	51	—	—
Twelfth	2	50	—	—

LENGTH OF GESTATION PERIOD — Table IV gives the average length of the gestation period for Jersey calves grouped according to weight at birth.

RELATION OF THE SIZE OF THE DAM. — Table III shows that, on the average, the first calf is lighter in weight than those born from mature animals. It is not clear from these data whether the cause of the lower

weight for first calves is the smaller size of the dams or the immaturity in age. This point was studied further by compiling the weights of the dams of the Holstein breed following the first parturition into groups based upon their weights. These data are given in Table V.

TABLE IV.

Relation of length of gestation period of Jersey cows to weight of calf at birth.

Number of animals	Weight Limits	Gestation Period
	lb.	days
4	33-37	274
10	38-42	277
20	43-47	278
42	48-52	281
41	53-57	281
34	58-62	282
19	63-67	284
13	68-72	284
3	73-77	281
3	78-82	285

TABLE V.

Influence of weight of dam upon weight of calf at birth.

	Average weight of dam	Average weight of calf	Weight in proportion to dam
	lb		dam
800 to 900 pounds	834	79	9.4
900 to 1000 pounds	948	87	9.4
1000 to 1100 pounds	1090	92	8.4

These figures suggest that the smaller weight of the first calves of heifers is probably due to the smaller size of the dam rather than to her immaturity.

THE INFLUENCE OF THE SIRE ON WEIGHT OF CALVES. — A study of the available data from this standpoint does not indicate any variation that can safely be attributed to this cause with the exception of a few cases of cross-breeding. Calves dropped by three pure bred Jersey cows and sired by a pure bred Holstein bull, averaged 73 pounds in weight, while other calves from the same cows sired by a Jersey bull, averaged 56 pounds in weight. Three calves sired by a Holstein bull from Ayrshire cows averaged 80 pounds compared with an average of 66 pounds for three calves from the same cows by Ayrshire bulls.

NUTRITION OF DAM. — The influence of nutrition of mother upon weight of calf at birth is shown in Table VI.

TABLE VI.

	Number of animals	Average weight of cow following calf's birth	Length of gestation period	Average weight of calf
Light fed Jerseys .	8	673	281	50
Heavy fed Jerseys	7	936	276	44
Light fed Holsteins . .	8	855	276	79
Heavy fed Holstein . . .	6	1 032	275	81

CONCLUSIONS. — Breed is the most important factor influencing the weight of calves at birth. Male calves average from 5 to 8 per cent. heavier than females. Calves produced by immature cows, two to four years of age, are smaller than those from mature cows five to ten years of age. There is a tendency for cows of an advanced age to produce calves rather smaller than those from cows in the prime of life. The length of the gestation period is not correlated with the size of the calf at birth except in cases of extremely large or small calves, when such a relation usually exists. The sire apparently has but little influence upon the size of the calf at birth, when both sire and dam are of the same breed, but in case of cross breeding the influence of the sire is evident. The nutrition of the cow during gestation does not influence the size of the calf at birth to any appreciable extent except possibly under most extreme conditions continued for a long interval.

945 — **A Comparison of Concentrates for Fattening Steers, in the United States.** — WARD, N. I., JORDAN, S. S. and LLOYD, I. R., in *United States Department of Agriculture, Bulletin No 761*, 16 pp Washington, April 7, 1919

I. THE COMPARATIVE VALUE OF COTTONSEED MEAL, COLD-PRESSED COTTONSEED CAKE, AND A MIXTURE OF COTTONSEED MEAL AND MAIZE FOR FATTENING STEERS. — To make a comparison of the relative feeding value of cottonseed meal, cold pressed cottonseed cake, and a combination of cottonseed meal and corn-and-cob meal, these three different concentrates were fed, with the same kinds of roughage, to 3 lots of 25 steers each, raised in Mississippi, aged 2 to 3 years and averaging 860 lb. in weight at the beginning of the experiment.

When on full feed each steer got —

Lot I Cottonseed meal 7.4 lb + corn silage 41 8 lb.

Lot II. Cold-pressed cottonseed cake 11 lb. + corn silage 31.5 lb.

Lot III. Cotton seed meal 6 lb + corn-and-cob-meal 3 lb. + corn silage 37 lb.

The steers of Lot II which received cold-pressed cottonseed cake consumed much less silage than the others, because of the larger amount of dry matter in the concentrates of their ration.

The average daily gain in weight per head was 2.04, 2.01, and 2.05 lb. respectively for the 3 lots, or practically the same for all. The greatest variation in the total gain was 4 lb. per head during a period of 123 days.

The cost of the foods was as follows: cottonseed meal \$22.50 per ton, cold-pressed cottonseed cake \$16.50 per ton, corn 70 cents per bushel, cowpea hay \$10 per ton, silage \$3 per ton. The feed cost per pound of gain in live weight was respectively 7.0, 6.8 and 7.8 cents for the 3 Lots and the net profit per head was \$5.45, \$5.50 and \$4.58, respectively.

Cottonseed meal at \$22.50 per ton. is as economical as cold-pressed cottonseed cake at \$16.50., for 3 lb. of the latter were of equal feeding value as 4 lb. of the latter. The former contained 40.4 % of protein and the latter 27.6 % of protein: the cold pressed cotton cake was eaten readily from the first by all the steers.

There was no advantage in feeding a one third ration of corn-and-cob meal combined with cottonseed meal. The degree of finish for the 3 Lots was the same and all sold at the same price, viz, \$7.35 per hundred pound.

The average dead-weight yield was 59.4 %, 59.1 % and 58.8 % respectively, which is high.

II. COMPARISON BETWEEN THE RATIONS: (a) COTTONSEED MEAL; (b) ONE THIRD COTTONSEED MEAL + TWO THIRDS BROKEN-EAR CORN; (c) ONE THIRD COTTONSEED MEAL + TWO THIRDS SHELLED CORN; FOR FATTENING STEERS. — Each of these three rations differing in concentrates was fed for 141 days to a lot of 25 two and three year old steers whose average initial weight was 825 lb. When on full feed they got the following daily rations:—

Lot I. Cottonseed meal 7 lb. + corn silage 40 lb. + oat straw 5 b.

Lot II. Cottonseed meal 3.5 lb. + broken ear corn 8.7 lb. + corn silage 36 lb. + oat straw 2 lb.

Lot III. Cottonseed meal 3.5 lb. + shelled corn 7 lb. + corn silage 38.5 lb. + oat straw 2.4 lb.

The steers of the 3 lots gained 1.56, 1.66 and 1.70 lb. per head per day on the average for the period of 141 days. The final average weights were 1044, 1059 and 1066 lb. respectively.

The feed cost per pound of gain was respectively 9.53, 10.82 and 10.75 cents. Lots II and III were accompanied by a herd of 25 hogs to consume the incompletely digested corn in the dung. The net average profit per head was \$15.19 for Lot I, \$11.87 for Lot II, and \$11.48 for Lot III, if no credit is given for the gain in weight of the hogs, which was about \$3 per steer.

Without hogs following the steers the feeding of corn would have been considerably less profitable than feeding with cottonseed meal alone; but as carried out the use of corn gave approximately the same profit. The dressed yields of each lot were 58.2 %, 57.8 % and 57.4 % respectively; the carcasses were well covered with fat. The steers sold for \$8.60 per 100 lb. live weight, except one steer of Lot I which sold for \$8 per

100 lb. In this experiment it is assumed that the cost of labour was covered by the value of the manure.

- 946 - **Research on the Galactagogic Effect of Certain Drugs, in the United States.** — MAC CANDLEISH, A., in *Journal of Dairy Science*, Vol. 1, No. 6, pp. 475-486, bibliography of 5 publications. Baltimore, March, 1918.

The effect of galactagogues on milk production in cows has been, indeed, very slightly studied experimentally. Furthermore results obtained by various authors, for cows or for other animals, do not agree.

The author has tested the effect on cows of the following drugs: — Alcohol; castor oil; pituitrin; pilocarpine and physostigmine; aloes; aloin, calomel and nux vomica; magnesium sulphate, sodium chloride and nux vomica. He got negative results, and even, generally, a reduction in the quantity of milk and butter produced; the reduction was particularly noticeable with the use of pituitrin and castor oil. Wide individual variations were shown by cows in response to these drugs.

- 947 - **Manioc Flour and Butter Production.** — GOUIN, ANDRÉ and ANDOUARD, P., in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. V, No. 1, pp. 43-44. Paris, January 8, 1919.

In this article, the writers inform the Académie of one of the causes leading to the butter crisis in France. During the years preceding the war many cattle breeders used to skim the milk given to their calves, and in order to increase the nutritive property of the skimmed milk, manioc or other farinaceous flours were added.

As during the war, these flours were not obtainable, the breeders were compelled to give their calves whole milk which had a serious effect upon butter production. If the breeders could be supplied with 1000 tons of manioc flour, they would be able to skim 17 million litres of milk, and make 750 000 kg. of butter, without the calves suffering in any way.

The writers show how necessary it is, in the interests of food production, that the cattle breeders of France should be furnished with manioc from the French colonies.

- 948 - **Correlation Between the Percentage of Fat in Cow's Milk and the Yield.** — ROBERTS, C., in *Journal of Agricultural Research*, Vol. XIV, No. 2, pp. 67-96 + 21 tables. Washington, July 8, 1919.

It is a generally accepted opinion that cows with a large yield of milk produce a smaller percentage of fat than do cows with a small yield of milk. To what extent this is true has, however, up to the present time never been demonstrated by careful scientific investigation. From the study of the records of 2 166 Ayrshire cows, JAMES WILSON (*The separate Inheritance of Quantity and Quality in Cows Milk*, in *Scientific Proceedings of the Royal Dublin Society*, New Series, Vol. XII, No. 33, pp. 470-479, 1910) concluded that yield of milk and percentage of fat were inherited independently of each other.

In a criticism of this work (Note on the Separate Inheritance of Quantity and Quality of Cow's Milk, *Biometrika*, Vol. VII, No. 4, pp. 548-550, 1910) K. PEAKSON, by means of a correlation table, showed that with a

increase in the yield of milk, there was a small but significant decrease in the percentage of fat.

In a later work (*The Principles of Stock Breeding*, pp. 121-122, London, 1912), J. WILSON states that high quality of milk, that is to say milk rich in fat, is produced by cows giving all kinds of yields high, average, or low, and the same may be said as regards milk of low quality. These facts would appear to prove that yield and quality are independent characters. It seemed to the writer, however, that it would be well to make a more careful statistical investigation of the matter.

A large body of data forming the greater part of the material for this investigation was furnished by the registers of the different American Associations for breeding milch cows. Only yearly tests were used. The method of finding the relation between the percentage of fat and the yield of milk was by means of the correlation table. The cows were divided according to their ages at the beginning of the experiment into the following 4 groups: — 2-3 years; 3 to 4 years; 4 to 5 years; 5 years and over.

The writer concludes from the results of his investigations, that a significant negative correlation exists between the percentage of fat in cow's milk and the yield for Jerseys, Guernseys, Holstein-Friesians, grade Jerseys, grade Holstein-Friesians, and cows unclassified as to breed. The correlation for Ayrshires is not significant in the subgroups classed in respect to age, but it is significant when these groups are treated as a whole.

The yield of milk increases with age. However, since all cows 5 years of age and over are classed together, it may well be that the yield decreases at some period beyond 5 years. PEARL and PATTERSON (*The Change of Milk Flow with Age from the Seven-Day Records of Jersey Cows*, *Maine Agr. Exp. Sta. Bull.* 262, pp. 145-152, 1917) showed that in Jersey cows, when the 7-day records are used, the maximum production is reached between the eighth and ninth year.

C CROWTHER (*Variation in the Composition of Cows' Milk*, *Journal of Agricultural Science*, Vol. I, part 2, pp. 149-175, 1905), from his records of Ayrshires, is of the opinion that maximum production is close to the eighth year. In the Jersey, Guernseys, and Holstein-Friesians the percentage of fat remains fairly constant for the different ages studied. However, the group of animals 5 years of age and over in the Jerseys and Guernseys shows a slightly lower percentage of fat than the younger groups. In the case of the Ayrshires, there is a gradual decrease with age. Between the youngest and the oldest groups there is a difference of 0.15 %. When judged by the standard deviation, age has no influence on the variability of the percentage of butter fat. But the class 5 years of age and over is more variable in the yield of milk than the younger groups.

This may be due to the inclusion in this group of old cows whose milk has decreased.

Using the standard of deviation as a basis of comparison, it is found that the breed has an influence on the variability of milk yield and per-

centage of fat. For variability in yield the breeds stand in the following order in an ascending scale: — Jersey, Ayrshire, and Guernsey practically the same, then Holstein-Friesian. For percentage of fat, the order is: Holstein-Friesian and Ayrshire about the same, Guernsey, Jersey.

The average production of milk is as follows — Holstein-Friesian 14 443.1 lb. — Ayrshire 9 417.1 lb. — Guernsey 8 644.4 lb. — Jersey 7 491.4 lb. The average percentages of fat for the different breeds are —

Jersey 5 392 lb. — Guernsey 5 033 lb. — Ayrshire 3 933 lb. — Holstein-Friesian 3 435 lb.

949 — **Testing of Purebred Dairy Cows in New Zealand.** — SINGLETON, W. M. in *The New Zealand Journal of Agriculture*, Vol. XVIII, No. 2, pp. 65-78. Washington, February 20, 1919.

The progress of the Certificate-of-Record System in 1918 has been considerable. During the latter part of 1917 some 118 breeders were being visited regularly by the Division's testing officers. For the corresponding months of 1918 there were 155 breeders on the list for monthly visits. The number of certificates issued during each calendar year since the commencement of the system are given in Table I.

TABLE I.

Breed	1913		1914		1915		1916		1917		1918	
	Ordinary	Repeat	Ordinary	Repeat	Ordinary	Repeat	Ordinary	Repeat	Ordinary	Repeat	Ordinary	Repeat
Jersey	67	104	14	91	4	94	11	94	13	113	8	
Friesian	48	7	11	62	9	44	5	62	14	57	14	
Ayrshire		17	1	12	1	9	3	4	3	4		
Shorthorn		—	—	2	—	7	—	21	—	22	—	
Totals	115	168	26	117	14	154	30	161	30	196	22	

Jersey. — During the year 1918 the maximum class increase in average production is shown by the four-year-olds, where the figures have been raised from 410 53 lb. butter-fat in 1917 to 448 41 lb. in 1918, an improvement of 37 88 lb. The 700 lb. butter-fat class has an accretion of one name, the 600 lb. class of five names and the 500 lb. class of eleven names. The milk records held by Mere of the junior two-year olds with 12164 lb. milk, containing 663.64 lb. fat and the butter-fat record by Madam Mayflower with 11793.2 lb. milk containing 763 41 lb. f. t. The list of Jersey bulls who have at least four C. O. R. daughters from as many different dams comprises the names of some thirty-two bulls, six of which were added during 1918. Majesty Fox stands first with 24 C. O. R. daughters.

Friesians. — An increase is shown in the average yield for each class save that of the senior four-year olds which was specially high for 1917. The junior four-year-olds have a high average this year (15 779.10 lb

milk and 576.13 lb fat) and the junior two-year-olds have also produced higher figures by a wide margin (11 281 lb. milk and 407.32 lb. fat against 9887.60 lb. milk and 353.73 lb. fat in 1917).

The championship milk-record is held by Westmere Princess Pietertje of the junior four year-olds class with 24 199 lb. milk, containing 939.78 lb. fat.

The list of Friesian bulls with four or more C. O. R. daughters, includes 20 names. The Friesian bull Prince Pietje Paxton qualified during 1918, has now seven C. O. R. daughters, only one of which was old enough for the senior two-years-old class.

Milking Shorthorns. — Among the seventeen mature records are one in the 600 lb. and three in the 500 lb. butter-fat class. The milk and butter-fat record is held by Willowbank Beauty with 15 725.80 lb. milk and 655.22 lb. fat.

Ayrshires. — Three breeders of Ayrshires patronised the C. O. R. testing in 1918. The milk record is held by Alexandra of the mature class of Waipapa with 14 636 lb. milk and 582.47 lb. fat.

The cooperation of the four Breeders' Associations connected with the C. O. R. work has again been very helpful to the Dairy Division during the past year.

950 — **French Cattle in Argentina.** — SAGNIER, HENRY (from a report by M. SIGNORET), in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. V, No. 18, pp. 532-533, Paris, May 14, 1919.

M. CHARLES SIGNORET has furnished data respecting the returns obtained in Buenos Aires from grass-fattened beef cattle.

From the point of view of the quality of the meat, crosses between the Charolais breed and the local cattle gave excellent results, better than those obtained from other breeds.

It has, however, been found in Paris, in the frozen meat trade, that the Argentine beef has the disadvantage of being too fat, further, the fat is not well distributed, whereas the carcasses of animals of the Charolais, Normand, and Limousin types yield more firm meat of prime quality, and the fat is better distributed, but there is no layer of suet.

In order to fulfil the trade requirements in France, Belgium, Switzerland and Italy and to overcome the existing prejudice against frozen meat, it would be well for the Argentine breeders to cross some of their native cattle with French beef breeds, which would enable them to supply the above-mentioned countries with the type of meat that is preferred there.

951 — **General Census of Cattle in Mauritius, 1918.** — HENRI ROBERT in *Department of Agriculture Mauritius Statistical Series Bulletin* No. 4, pp. 1-16 Mauritius, 1918.

This bulletin gives the results of a census of cattle in Mauritius conducted during August 1918, and by comparison with data previously given for the census of 1914, allows the effects of war conditions on the milch, working and breeding stock of the Colony to be accurately gauged.

The data adduced show that during the last four years the total number of stock in the Colony has diminished by over 8 000 head and consists of 11 224 bullocks, 11 183 cows, 6 447 heifers and 4 116 small bulls.

It is interesting to compare the diminution in numbers with the increased value of live stock. The value of the 41 300 head of cattle existing in 1914 was placed at Rs. 3 400 000. The general average per head was estimated to be about Rs. 82, with particular averages as follows, as compared with the averages of 1918:—

Description of animals	Value per head	
	1914	1918
Milch cows.	80	200
Calves	20	50
Adults in herds	70	130
Young animals in herds .	40	80
Bulls	150	300
Drift bullocks	155	350

At present the general average value per head is estimated to be Rs. 194, making for the total of 32 970 head of cattle at present recorded in the Island a total of Rs. 6 400 000, that is to say an increase of Rs. 3 000 000 (90 %) on a number of animals which is 20 % less than in 1914.

952 **The Open Shed compared with the Closed Barn for Dairy Cows.** — WOODWARD, F. F., TURNER W. I., HALE, W. R. and McNULTY, J. B., in *U. S. Department of Agriculture Bulletin* No. 730, 13 pp., Washington D. C., November 15, 1918.

Twenty-one cows were used in the experiment herd, being divided into two groups, which were kept alternatively in the open shed and the closed barn for three years.

In general, little difference could be noted in the contentment of the cows under either open-shed or closed-barn conditions. There seems to be little, if any, difference in the amount of actual sickness observed under the two conditions. But the closed barn was a modern, well ventilated structure, and in many of the common poorly ventilated dairy barns the impure air would doubtless be an important factor in determining the comparative merits of the system. The period of housing cows is placed at an average minimum of five months, from November to March, for most sections of the United States.

The results of the experiments are summarised as follows:—

The cows consumed somewhat more feed and produced slightly more milk when kept in the open shed than when kept in the closed barn. The increase in production was not quite large enough to offset the extra feed cost.

When kept in the open shed there was a tendency for "boss cows" to deprive weaker individuals of their feed and of the normal advantages of the shed, which resulted in lower milk yields from the weaker and more timid cows.

All operations considered, milking and feeding excluded, slightly more labour was required to care for the cows when kept in the open shed.

The manure was apparently well preserved, until it could be hauled to the land, under the open-shed system. It was also handled more economically than in the closed barn. Cornstalks in the manure were sufficiently decomposed to be handled successfully with the manure spreader.

Under the open-shed system, 68 % more bedding was required for each cow, but the cows were cleaner and more comfortable. There was little difference in the time required to bed them under the two systems. It is possible to use cornstalks or other coarse material for bedding in the open shed.

There appeared to be little if any difference in the frequency of injuries to cows under either open-shed or closed-barn conditions.

953 - **Sheep-Breeding in Italy.** — VEZZANI, V., in *Minerva agraria*, Year XI (VI of the 2nd Series) No. 5-6, pp. 49-52. Milan, March 1-16, 1919.

From the point of view of numbers, sheep are the most important stock in Italy. According to a general census of stock taken on March 19, 1908, the sheep returns were as follows: lambs (of both sexes) of less than one year of age 2 738 244 — sheep one year old and over; rams 382 809; ewes 7 874 216; castrated sheep 167 657 — total 11 162 926 sheep, as against 6 198 861 head of cattle, 2 193 938 horses, mules and donkeys, 2 507 798 swine, and 2 714 878 goats.

Since 1908, the number of sheep has continued increasing, especially in Central and Southern Italy, where sheep-breeding is most developed. During the war, the sheep did not decrease in the same manner as other stock, so that the census returns for 1918 were: lambs (of both sexes) less than one year old 2 694 529 — rams 376 243 — ewes 8 571 335 — castrated sheep — total 11 735 910. This represented an increase of 590 984 head, or about 5 %, between 1908 and 1918. The value of these sheep now amount to about 1 milliard francs.

The Italian animals are often very much more valuable for their milk, than for their wool or mutton.

Sheep are, as a rule, thriftier than cattle and turn to better account the poorer and coarser products of the farm, adapting themselves more easily to high pastures and to the most rocky and awkwardly situated grazing grounds. This does not, however, mean that a well-fed sheep will not yield better products than a poorly nourished animal.

In the Campagna Romana, the richest pastures are reserved for the sheep, while the horses, mules and donkeys, as well as the cattle which are also reared in the "brado" or "semi brado" manner (on pasture, or seasonal pasture) have to content themselves with the stubble and the arid pastures that the migrating flocks have abandoned. Generally, however, land which is capable of producing the best forage is preferred for cattle breeding. Sheep require a grazing ground and cannot with impunity be kept in sheds throughout the year. Sheep-rearing is practised in large country estates rather than on small properties.

In Italian rural economy, it is chiefly along the Central and Southern Apennines, and in the islands, that sheep are of much importance. There,

in addition to sheep-breeding on a small scale on general farms, change of pasture has been the rule from the most remote times. The flocks go up to the high Apennine pastures in summer, remaining there until the autumn, when they descend to winter on the fallow land and permanent pastures of the summer farms of the Maremma. Sheep breeding is not generally practised by the land-owners of the plain, but has become an autonomous industry in the hands of shepherds who rent pastures in the plain, and on the mountains, and exploit the flocks for their own advantage.

Sheep-rearing is also carried on in the Alps where it enables use to be made of high pastures (above 2000 m.) which are rocky and steep. In the winter, the animals return to the plain, to pastures specially rented for the purpose. On the medium-sized and small farms of Central Italy, the sheep consume the forage of inferior quality which is not good enough for the cattle. They graze in the stubble, by the roadside, on fallow land, and on the last cutting in the fields. In winter, they are kept in sheds and are fed upon olive branches and the dry leaves of the hornbeam, poplar, oak, etc.

Among the most important Italian breeds the following are usually mentioned: the *Bergamasca*, a tall animal with a thick fleece of inferior quality; it is a triple purpose sheep, is very thrifty and lives on the high Alpine pastures, as well as on the Bergamo and Brescia plains — the *Biellese* or Piedmontese, or *fiandona*, which resembles the preceding breed, — the "Padovana", a tall sheep producing abundant milk, and excellent wool. It is found throughout a large part of Venetia.

(Other Venetian breeds are the *tosetti*, the *mont-lisani*, the Lamon and Belluno sheep which yield much milk), the *vissana* and the *sopranissana*. The two latter breeds are reared in greater numbers than the preceding ones, they are common in central Italy, and were long ago improved by the introduction of merino blood. They are of medium size, rather well-shaped, thrifty and quiet; they produce milk (from which the highly prized Roman *pecorino* is made), wool (of excellent quality and much in request by wool-combers, because it gives little waste), and mutton. Still other breeds are the *gentile* of Apulia, which has been greatly improved at different times by the importation of merinos from Spain; it is a average sized, quiet, very strong animal, equally good as a wool, milk and mutton producer, its short wool is excellent — the breeds with *straight* not curly wool (which is used solely for mattresses) and which are reared in Murges (Apulia) and in Ionian Calabria — the Calabrian and Sicilian breeds, thrifty, quiet, badly-shaped animals with coars straight wool — the *Tunisian* or Barbary breeds with fat tails, very common in Sicily; this sheep gives a large amount of coarse wool, mutton of inferior quality, and but little milk — the *Sardinian*, of African origin, a small sheep, with inferior wool, and producing little mutton, but giving a large quantity of milk from which good cheese is made.

As a whole, Italian sheep-breeding is based on rearing native races. The efforts made of late years to improve them have not had much effect. On the initiative of the ministry of Agriculture, Rambouillet merino

sheep have been imported for the purpose of obtaining animals that mature more quickly, and also in order to increase the size and the milk production of the native races. The results, as far as the products of the crosses were concerned, proved most satisfactory, but were less encouraging from the standpoint of breeding a pure race, and not enough crossing was effected to influence sheep rearing as a whole.

Milch ewes imported from east Frisia into the Campagna Romana, have never been able to adapt themselves to the Italian climate. Other crossing experiments carried out here and there with English wool and mutton breeds gave no results and had to be abandoned for various reasons.

The most important economic functions of the Italian sheep are the production of milk and wool; mutton is in little demand, and is of secondary importance.

Therefore, the objects of improving sheep-breeding are to obtain better and more milk and wool, and to attain this without interfering with the harmonious connection existing between milk and wool production in the best Italian flocks. This aim can be attained in two ways: — by the systematic selection of the native breeds; by crossing the latter with foreign breeds possessing the desired qualities. Such foreign breeds are, however, by no means numerous, and as it has been seen, crossing with the German breed from East Frisia gave negative results. The writer has tried the Larzac breed which comes from the South of France where it is chiefly bred for its milk, which is used in the manufacture of the celebrated Roquefort cheese. These sheep give on an average 60 litres of milk a year, their wool is also very good, and they never produce less than 2.5 kg. of wool per head.

954 - **Sheep-Breeding in Corea.** — *Bulletin économique de l'Indochine*, Year XXII, New Series, No 134, pp. 117. Hanoi-Haiphong, January-February, 1919.

The Government of Corea has set apart in the budget of 1919, the sum of 112 000 yen for the encouragement of sheep-breeding in the country.

Three years ago, the Government bought 400 Mongolian sheep (rams and ewes) and consigned them to the Suwon and Seipo model farms with excellent results.

In 1917, a good number of these sheep were distributed among the farmers in the northern provinces, and in 1918, a further consignment was made to farmers in the southern provinces.

955 - **Improvement of Poor Sheep-pasture in New Zealand.** — ASTON, B. C., in *The New Zealand Journal of Agriculture*, Vol. XVIII, No. 1, pp. 15-27. Wellington, January 20, 1919.

The experiments on the improvement of poor sheep-pasture, here recorded, were conducted at the Wallaceville Laboratory Farm and effected by top-dressings with various substances and judged in the main by the live-weight increase of the animals grazed and the carrying capacity of

the pasture. The area selected was of very inferior carrying capacity in the unimproved condition, representing a considerable area of similar land in the Upper Hutt Valley gravel plain. The depth of soil above the gravel is very shallow, sometimes not more than 1 ½ in., but usually from 4 in to 9 in. The porous subsoil so near the surface tends to dry up rapidly the soil in the summer. The grass which is the dominant constituent of the pasture is *Danthonia pilosa*, a highly drought-resisting native grass and eminently fitted to survive on the shallow dry soils of this area. The soil is fairly well supplied with total potash and nitrogen and available potash, but deficient in available phosphoric acid. The experimental paddocks were laid off into 75 1/20 acre plots, the subdivisions being made by sheep-netting. Five of these paddocks, Nos. 1 to 5, were on shallow soil with numerous depressions in the surface, the pasture being mostly *Danthonia pilosa*. The pasture on paddocks 6 and 7 was of much better quality, the soil being deeper and improved by ploughing and seeding better grasses.

The cost of the various dressings per acre was as follows:

		<u>£</u>	<u>s.</u>	<u>d.</u>
Paddock No 1	2 2/3 ton fine carbonate of lime	0	13	0
" "	2 Control			
" "	2 Dressing as on No 1 plus 5 cwt Makatea Island phosphate.	1	10	6
" "	4 Rough unground limestone at 2 s per ton and 3 s per ton cartage, and extra cost of spreading	0	15	0
" "	5 Epsom phosphate 5 cwt	1	4	6
" "	6 Basic superphosphate 5 cwt	1	5	0
" "	7 Basic slag 5 cwt	1	7	6

RESULTS OF THE EXPERIMENTS. — The botanical survey, of the pasture showed that the poor native *Danthonia* grass is reduced by dressings of limestone and of the mixture of limestone and phosphates, and that the poor exotic grass sweet vernal (*Anthoxanthum odoratum*) is also somewhat diminished by these dressings. On the other hand, the valuable suckling-clover (*Trifolium minus*) is increased by phosphate and limestone, while the valuable white clover is very greatly increased by phosphate and greatly by limestone. The valuable exotic crested dogstail (*Cynosurus cristatus*) is greatly increased by limestone and phosphate, and more greatly by limestone; the valuable exotic cocksfoot (*Dactylis glomerata*) is also much increased by phosphates and limestone. The deleterious moss is diminished by liming, and almost disappeared with the aid of phosphates and limestone. Bare ground has almost disappeared with the aid of phosphates and limestone.

During the grazing experiments the animals were weighed every month, and the following table shows the differences in the average live-weights in pounds per sheep due to the feeding on the pastures.

Results of Grazing Experiments.

Paddock	No. 1 lb.	No. 2 lb.	No. 3 lb.	No. 4 lb.	No. 5 lb.	No. 6 lb.	No. 7 lb.
First season (12 weeks)	16.3	20	21.1	17.6	17.8	30.3	25.5
Second season (13 weeks)	16.0	12	15	12.21	12.7	20.25	24.6
Third season (very wet) (26 weeks) .	—	41.7	46.5	50	—	—	—

The results of the weighings of the period from May to December during the third season are considered important enough to give in full for paddocks Nos. 2, 3, and 4, and are as follows (in pounds) :—

Dates of weighings	May 30	June 24	July 13	July 31	Aug 13	Aug 30	Sept 24	Oct 8	Nov 1	Nov 26	Dec 11
Average weight of 8 sheep in paddock No. 2 (Control)	94	103	98½	99¾	101½	102¾	106	109¾	121	103¾	135¾
Average weight of 8 sheep in paddock No. 3 .	83½	90¾	89	91½	92¾	94¾	99¾	104½	114½	123½	128¾
Average weight of 8 sheep in paddock No. 4	89½	91½	90¾	96	98	100½	106	111¾	124¾	135¾	130¾

In conclusion the Author points out that these experiments at Wallaceville are carried out under exceptional difficulties, chief of which are the rapid drying-up of the soil and pasture in summer. Although the very good results obtained in 1918 may be largely due to the abnormally favourable rainfall and therefore should be continued for a series of years before it is possible to obtain an idea of the average improvement due to fertilisers, the author draws attention to this method of improving poor *Danthonia* country following "birch" forest of which there are such large areas in the Dominion.

956 - **Values of Various Foods for Fattening Pigs** Research in Oklahoma, United States. — MALONI, J S (Department of Animal Husbandry), in *Oklahoma Agricultural and Mechanical College, Experimental Station, Bulletin, No. 120* pp 7, 5 tab Stillwater, Ok. Oct., 1918.

It is known that Kafir corn has the same drawback as maize for fattening pigs, that is to say it is rich in starch and fats but contains too little protein. Certain foods are consequently used to supplement the lack of protein in kaffir corn and maize; among these, those generally used are slaughter house refuse ("tankage"), cottonseed meal, alfalfa hay, and peanut meal.

To ascertain the comparative values of some of these supplements Professor W. L. FOWLER undertook a test beginning November 29, 1916, and ending February 28, 1917 with pigs divided into 4 lots. The pigs

had easy access to each variety of food given them and could choose the kind and amount of feed they wanted.

Lot I was given kafir corn and tankage.

Lot II Kafir corn and peanut meal.

Lot III Kafir corn and cottonseed meal.

Lot IV. Kafir corn, tankage, peanut meal and cottonseed meal.

The gain in weight per day per head and the quantity of food required for a gain of 100 lb. were respectively : — *Lot I*: 1.35 lb. and 473 lb. ; *Lot II*: 1.01 lb. and 587 lb. ; *Lot III*: 0.97 lb. and 594 lb. ; *Lot IV*: 1.51 lb. and 474 lb.

Lot IV which got Kafir corn and all three supplements made the best gains ; however the amount consumed for 100 lb. of gain is practically the same as for *Lot II* fed with tankage only as a supplement. Neither peanut meal nor cottonseed meal as a supplement gave as good results as tankage or all three supplements combined. *Lot IV* getting all three supplements used a larger percentage of supplements than the other Lots, and *Lot I* which got kafir corn and tankage made the most economical use of the supplements.

The author, wishing to verify the results of the previous test, made similar experiments in 1918 which began on January 29, and lasted until April 9: the feeds used were the same and, as before, the pigs had a free choice of the food offered. The pigs had been pastured on alfalfa and other forage crops with very little grain ; consequently they were thin. They were well housed during the test and were thus protected against cold.

The gain in weight per day per head and the quantities of feed for 100 lb. gain in weight were respectively : — *Lot I*: 1.97 lb. and 361 lb. ; *Lot II*: 1.54 lb. and 430 lb. ; *Lot III*: 1.34 lb. and 430 lb. ; *Lot IV*: 1.97 lb. and 413 lb.

It will be noticed that the greatest gain in weight per day was in the pigs (*Lot I*) getting tankage in addition to kafir corn and of *Lot IV* which got all three supplements ; but taking into consideration the amount of food eaten to produce a gain of 100 lb. in weight it will be noted that tankage (*Lot I*) gave the most economical results. Peanut meal gave slightly better results than cottonseed meal. From the above it may be concluded that tankage is the best supplement to kafir corn in fattening pigs.

The author also tested the comparative values of corn, kafir corn and " darso " (a new plant the grain of which is used for feeding in the State of Oklahoma) in rations for fattening pigs; 24 pigs of the same breed which were used in the test were divided into 3 lots: *Lot I* were fed with corn and tankage; *Lot II* with " darso " and tankage; *Lot III* with kafir corn and tankage.

The gain in weight per day per pig and the amount of food consumed for 100 lb. gain in weight were respectively : — *Lot I*: 2.01 lb. and 348.7 lb. — *Lot III*: 1.97 lb. and 423 lb. — *Lot II*: 1.97 lb. and 370 lb. It will be noted that the gain in weight was about equal in the lots but if the quantity of food required for a gain of 100 lb. is taken into consid-

ration it will be seen that corn is the most advantageous food ; kafir corn comes next and " darso " last. But taking into calculation the quantities of each of the foods eaten and of the supplement tankage in each lot, the author concludes that " darso " requires more supplement than kafir corn and kafir corn less than corn.

957 - **Hog Pastures in the Southern States of America.** — CARRIER, L. and ASHBROOK, F. G., in *Farmers Bulletin* 951, U. S. Dept. of Agric., pp. 20. Washington, May, 1918.

The production of green fodder is essential to the economical production of pork ; the best results are given by using permanent pasture, supplemented by temporary pasture composed of foder crops of rapid growth and heavy yield. On an average, 1 acre of pasture is required for each brood sow. Further, mature crops such as maize, soya beans, peanuts, and velvet beans are required in autumn for fattening. Oats, rye and wheat give satisfactory winter grazing. Green food alone is little better than a maintenance ration ; if rapid gain is desired plenty of grain must be given, that is, by the rule, as much as the pigs can eat without waste. The best way to regulate grazing is to keep the pigs in temporary enclosures fenced with wire netting supported by stakes which is moved as soon as the enclosed area has been grazed down. As a rule, the pasture should be fairly well stocked, because pigs like the young tender grass.

The authors discuss the pork producing values of the following forage plants : — maize, sorghum, winter cereals, lucerne, black medick (*Medicago lupulina*) and hop clover (*Trifolium procumbens*), red clover, crimson clover, soya beans, velvet beans, cowpeas, peanuts, chufas (*Cyperus esculentus*), sweet potatoes, mangels and rape ; and they recommend the following rotation of crops and pasturage systems : —

FOUR YEAR ROTATION FOR GENERAL CONDITIONS. — The system generally adopted is : —

1st year. — Cotton, seeded with crimson clover, *Medicago denticulata*, or rye.

2nd year. — Soya beans, sorghum, cowpeas, peanuts, or sweet potatoes, followed by a winter cereal seeded in autumn.

3rd year. — Wheat, oats, oats and vetch, or rye, followed by cowpeas or soya beans.

4th year. — Maize, with a cover crop such as crimson clover seeded when the last cultivation is carried out.

PIG PASTURING SYSTEMS FOR FERTILE BOTTOM LANDS. — This system consists of 10 acres of permanent pasture and 3 fields of an area of 3 acres each, which is sufficient for 10 brood sows and their litters.

1st year. — Maize, in alternate rows with velvet beans to be used for late autumn and winter grazing.

2nd year. — Sorghum and early cowpeas, to be grazed in midsummer and early autumn ; then 2 acres to be seeded with rape and 1 acre with mangels for autumn and winter grazing.

3rd year. — Soya beans or peanut, to be grazed in early autumn,

followed by seeding with oats or rye and crimson clover for winter and spring grazing.

PIG PASTURING SYSTEMS FOR FERTILE UPLANDS. — Permanent pasture, 10 acres of Bermuda grass and *lespedeza*, 3 fields of an area of 3 acres each in which the following rotation is adopted (for 10 brood sows and their pigs) : —

Field A :—

- 1st year. — Maize, with soya beans or velvet beans in alternate rows.
- 2nd year. — Sorghum and early cowpeas, seeded in autumn with oats or rye and crimson clover.
- 3rd year. — Oats or rye and crimson clover followed by soya beans or peanuts.

Field B :—

- 1st year. — Sorghum and early cowpeas, seeded with oats or rye and crimson clover in the autumn.
- 2nd year. — Oats or rye and crimson clover, followed by soya beans or peanuts.
- 3rd year. — Maize, with soya beans or velvet beans in alternate rows.

Field C :—

- 1st year. — Oats or rye and crimson clover, followed by soya beans or peanuts.
- 2nd year. — Maize, with soya beans or velvet beans in alternate rows.
- 3rd year. — Sorghum and early cowpeas, seeded with oats or rye and crimson clover in autumn.

PIG PASTURING SYSTEM FOR POOR CLAY UPLANDS. — For 10 brood sows and their pigs, 15 acres of permanent pasture and 3 fields of an area of 3 acres each, in which the following rotation is practised, are required :—

- 1st year. — Maize and cowpeas seeded early and followed by rye and crimson clover seeded after the maize has been grazed.
- 2nd year. — Soya beans, to be grazed at the same time as the maize or later.

3rd year. — Sorghum and cowpeas mixed, to be grazed in midsummer, then oats to be seeded for winter grazing.

PIG PASTURING SYSTEMS FOR LIGHT SANDY SOILS. — For 10 brood sows and their pigs, 10 acres of permanent pasturage and 4 fields of an area of 3 acres each, in which the following rotation is practised, are required :—

- 1st year. — Maize, in alternate rows with soya beans or velvet beans.
- 2nd year. — Chufas or sweet potatoes.
- 3rd year. — Peanuts or cowpeas, followed by rye and crimson clover.
- 4th year. — Winter oats and vetch.

958—**Systems of Hog Farming in the South-eastern States of America.** — HASKELL, E. S., in *Farmers Bulletin* 985, United States Department of Agriculture, 38 pp., 12 fig. Washington., June, 1918.

The author describes the good management of farms where hog raising

is carried out in the coastal plains of the south-east of the United States and refers to: — Systems of pasture providing good grazing throughout the year; rational methods of treatment; best breeding methods; the number of pigs to raise per unit of area, the most suitable times of the year for farrowing and marketing; diseases; expenses other than for feed. He deals in detail with various fodder plants for grazing, grown in the district — oats, rye, rape, Bermuda grass or dogs tooth grass (*Cynodon Dactylon*), cat-tail millet or spiked millet (*Pennisetum typhordeum*), early Amber sorghum and Orange sorghum, early maize, crab-grass (*Salicornia herbacea*), Florida beggarweed, Chufa (*Cyperus esculentus*), peanut, velvet bean (*Mucuna pruriens* var. *utilis*), sweet potatoes. He gives the following table showing the usual planting and grazing periods and the carrying capacity of crops for grazing pigs in the southern coastal plain of Georgia.

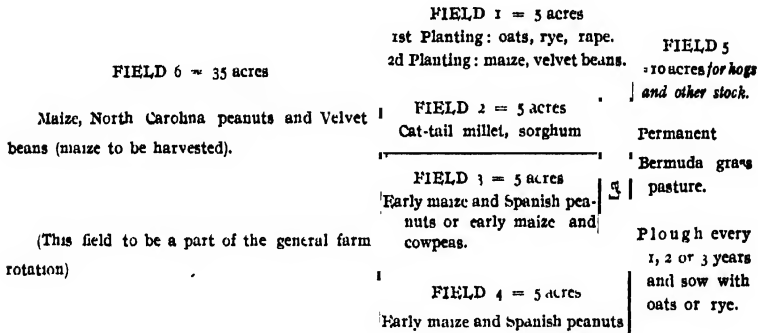
Crop	Usual planting Period	Usual grazing period	Average length of grazing period	Average pounds of hogs (150 lb) per acre	Average pounds of gain from an acre of crop
Maintenance crops, —					
			Months		
Oats (grain crop)	October	1 Jan - 1 March	1 9		
Oats (for pasture only)	October	15 Jan - 10 May	3 7		
Rye pasture	October	15 Jan - 1 May	3 5		
Rape	15 Nov - 1 Feb	15 Jan - 15 May	3 2		
Bermuda grass		15 Apr - 1 Oct	5 5		
Cat tail millet	15 Mar - 1 Apr	1 May - 10 July	2 3		
Sorghum	April	1 June - 1 Aug	2 2		
Finishing crops —					
Cowpeas	April	15 June - 25 July	1 5		
Early Dent corn	5 Mar - 25 Mar	1 July - 15 Aug	1 6		200
Spanish peanuts	15 Mar - 10 Apr	1 Aug - 20 Sept	1 6		358
Oat stubble		1 July - 10 Aug	1 3		
Watermelon culls		1 June - 30 July	2 1		
Chufas	April and May	15 Sept - 1 Dec	2 1		
Sweet potatoes	5 May - 5 July	20 Oct - 31 Dec	2 3		
North Carolina peanuts	20 Mar - 15 Apr	15 Sept - 1 Jan	3 4		
Velvet beans (in maize)	April	15 Nov - 15 Feb	2 8		

* Insufficient data to furnish reliable averages

Feeding with peanuts and chufas makes the pork "soft" and the lard "oily" so that pigs so fed sell for less than those fed on maize i. e., with harder lard. To avoid this defect a ration of maize, 1 or 2 lb. per day per 100 pounds of live weight, is given while peanuts are being grazed and, during the last 3 or 4 weeks of the fattening period, about 4 pounds of maize grain per day for every 100 pounds of live weight, or better still four-

fifths of the ration in maize and one-fifth in cottonseed meal, is substituted for the peanuts.

The author recommends the system indicated in the diagram below for the pasturage of 10 sows, 1 boar and 100 hogs.



959 - On the Possibility for Breeders to obtain Cocks or Hens according to their Wishes. — LIENHART, in *Comptes rendus de l'Académie des sciences*, Vol. 160, No. 2, pp. 102-104 Paris, July 15, 1919.

POULTRY

The author's procedure consists on knowing how to recognise sex in the egg before incubation has commenced.

In all kinds of fowls, the cock is always larger and heavier than the hen of equal age. The difference in the weights of the respective sexes varies, according to the breed, between 0.5 kg. and 1 kg. or sometimes even more. The author has remarked that this difference of weight, in a less degree, is noticeable in chickens; it even appears in the very young chicks (differences of 18 to 27 g. n. for chicks of 5 days old). It was, therefore, natural to think that this difference in weight would also be found in the egg, but it was necessary to furnish experimental proof.

A first attempt gave no results, having been made with eggs of mixed bred hens. In fact, in a mixed breed all the hens, even if they belong to the same brood, do not lay eggs of similar weight. They group themselves, in this respect, according to their respective origins, and in the same hen-house where all the layers are similar, that is to say all of equally mixed breed, distinct families exist, from the point of view of the average weight of the egg, regular lines which can be separated by selection, some laying small eggs, other eggs of medium weight and others again that lay large eggs. Consequently, in choosing for experiment the larger eggs out of a lot laid by mixed bred hens one simply eliminates all the eggs of maximum weights laid by the lines giving small eggs and takes only those of lines giving large eggs, and selection of the eggs is illusory. It is therefore indispensable to carry out the experiment with eggs laid by a pure bred race. This is what the author did in the spring of 1918, working with Leghorns. In that breed, the average weight of the cocks is 3 kg, and of hens is 1.90 kg.; the average weight of eggs is 62 gm.; the difference between

extremes is 16 gm., the smallest eggs weighing 54 g. and the largest 70 g.; few eggs weigh less than 58 gm. or more than 66 gm. Sixty eggs, laid by hens all belonging to one brood and chosen out of the largest of a lot of 350, were placed in the incubator (these eggs weighed between 59 and 70 gm. each). On hatching, they gave 48 chicks of which 37 were cocks and 11 hens, a proportion of 77 % of cocks. This result is convincing. It can, therefore, be affirmed that for a given breed and a homogenous brood the heavier eggs ought to produce cocks and the lighter eggs hens.

The author has tried still further to improve his method. As all young hens of 1 year old lay eggs noticeably smaller and lighter than the normal average, and as, on the other hand, in the course of the year, the eggs of the same layer, even if she is full-grown, are noticeably smaller at the beginning and at the end of the laying season than in the middle, it is indispensable that all the laying hens should be of equal age and that the eggs should be collected when the laying is at its maximum. It would be well to set all the eggs of the selected lot separating the heavier from the lighter.

By marking on each egg set to incubate its exact weight, by breaking it when it is about to hatch and by making a post mortem examination of the chick to find out the sex, it would be possible to find, with regard to the initial weight of the egg, the sex which it contained and thus know the weight at which the determination of the sex by weighing becomes doubtful, for a given breed.

960 - **Correlation between Egg Production during Various Periods of the Year in the Domestic Fowl.** — HARRIS, J. A. and BLAKESLEE, A. F. (Station for Experimental Evolution, Cold Spring Harbor, N. Y.), in *Genetics*, Vol 3, No. 1, pp. 27-72, 2 diagr., bibliography of 6 works. Princeton, N. J., Jan., 1918.

Results of a biometric study of the relationships between egg laying during different periods of the year in White Leghorn hens. The constants are based on two international egg laying competitions held at Storrs, Connecticut. The constants for each of the two years are in very close agreement with each other.

There is a significant positive correlation between the number of eggs laid by a hen in any month of the year and the number of eggs laid in the whole year. The correlation coefficient r varied between 0.38 and 0.69 in 1913-1914, and between 0.37 and 0.70 in 1914-1915; during these two years the average was 0.550 and 0.562 respectively.

The correlation between the record of one month and the egg production of the year, serving as a basis for formulæ by which the production for a whole year may be predicted, has great practical importance. As a biological constant it has the disadvantage that it is, to a certain extent, spurious, due to the fact that the monthly egg laying figures are included in the annual total which is correlated with each month's production. That is the reason why the authors have studied the correlations between each month's record and the production of the other 11 months of the year.

These correlations, like those between the monthly and annual egg production, are positive and are significant from a statistical point of view; they varied between 0.30 and 0.57 in 1913-1914 and between 0.24 and 0.57

in 1914-1915. The constants are on the average 21 % less than those expressing the correlation between the monthly and the annual production.

The high egg production of a hen does not, therefore, generally depend much on a high production in a given month, but on a permanent differentiation (at least during the first year of laying) in the egg laying capacity of the hen. This conclusion is fully confirmed by the correlations between the monthly records. These are always positive, but not uniform in magnitude. Two laws governing the intensities of these relationships are discernable, although they tend mutually to obscure each other: — (1) the correlation between the monthly egg production tends to become smaller as the two months considered are more widely separated; (2) the correlation between the egg production of the autumn and winter months, at the beginning and end of the year of the competition, is closer than that between the egg production of the spring and summer months.

The relative influence of the various months of the year on the variations in the annual production differs greatly. The authors have shown that, during the winter months (November, December, January and February), and the following autumn months (August, September and October), the egg production is greater than the theoretical production when the total annual production exceeds the normal. The spring and summer months, from March to July, contribute relatively less to the excess of the total above the normal egg production.

From a practical point of view, the result of greatest importance is the demonstration of the fact that trap-resting and record throughout the year are not necessary for obtaining conclusions of great value. The record of one month suffices for dividing the hens into groups differing widely in annual egg production. It would, therefore, be possible, at the commencement of the laying season, after one month to divide the flock approximately into two halves, one of which will lay, on the average, 136 to 139 eggs a year and the other from 167 to 170; or, if it is thought desirable to retain only a quarter of the flock for laying, a production of from 176 to 187 eggs annually per hen may be secured. The selection of hens for breeding purposes in September or October would be made among the quarter containing the best laying hens of the flock whose annual average egg production would be about 190 eggs per hen.

961 - **Cantonese Fowls, a Breed suited to the Philippines.** — LINDAYAG Y MAGTIRA, G., in *The Philippine Agriculturist*, Vol. VII, No. 5, pp. 137-148, 6 tab., bibliography of 8 publications, Los Baños, Dec., 1918.

So far poultry farming has not been practised on a large scale in the Philippines: a poultry farm there which has from 100 to 150 fowls is considered large. Many investigators, however, have recognised that the country is well suited for poultry both from the point of view of the local conditions and that of the food resources (rice, maize, sorghum, millet, leguminous seeds, etc.).

The author wished to find out what breed was best suited to the country among imported fowls of different breeds and crosses between some of

them and the indigenous fowls; he has come to the conclusion that the Canton breed is best.

Cantonese fowls stand the change of conditions better and are more resistant to disease; the young chickens develop sexual maturity earlier and lay earlier than other breeds. But the eggs of Cantonese hens weigh less (average 36.16 gm.) than those of the indigenous breed (38.25 gm.). Cross breeds also give heavier eggs; for example, the cross Black Orpington \times indigenous and the cross White Leghorn \times indigenous have given eggs weighing on the average 532.51 gm. and 513.79 gm. per dozen respectively and exceeding the weights of Cantonese eggs by 98.59 gm. and 79.87 gm. per dozen.

The author remarks that the breed called Cantonese is not a pure breed; under this name are described fowls with buff plumage bred in the Canton district (China) and exported under this name. The want of purity in the breed must be taken into account and the results obtained must not be generalised by attributing to all fowls exported under the name "Cantonese" the qualities found in those imported into the Philippines and studied by the author.

962 - **Experimental Station for the Development of Poultry-rearing in Lombardy.**

— PIROCCHI, A. (Direttore dell'Istituto zootecnico della R. Scuola Superiore di Agricoltura di Milano), in *l'Agricoltura italiana illustrata*, Year I, No. 6, pp. 17-23, 9 fig. Milano June, 1919.

In October, 1918, the Scuola Superiore di Agricoltura of Milan and the establishment "Pollai di Parè al Lago" at S. Dionigi di Val Madrera (Como) agreed to adopt the following programme with the object of developing poultry rearing in Lombardy:—

(a) To spread good practical rural methods of poultry rearing by means of temporary yards and newspaper propaganda.

(b) To incubate gratis, for farmers, eggs of hens of mixed breed and pure breeds recognised as suitable to Lombardy.

(c) To distribute eggs and chicks at favourable rates or even gratis, under special conditions.

(d) To study and make new crosses to get an increased production of eggs and poultry for table use and to improve the quality of the latter,

(e) To study and apply preventive measures and treatment of diseases of poultry.

(f) To help in every other way the development of poultry-rearing in Lombardy.

The establishment occupied about 2.5 ares and contained 17 hen-houses of 6 sq. m. for breeders; 5 henhouses of 3 sq. m. for breeders (small lots); 5 incubators holding 650 eggs and 10 turkey incubators capable of hatching altogether 250 other eggs at each hatching; 8 warm fostermothers holding in all 650 chicks; 8 cold foster-mothers, for chicks of about 2 months holding 250; 8 shelters for pullets holding about 250 each. This installation suffices for about 6 000 in a season. The following breeds were reared:— White Leghorn, Gold Leghorn, White Orpington, Buff Or-

pington, Faverolles, Houdan, Malines Cuckoo, Rhode Island Red, Langshan Croad, mixed bred (called "Lombardy mixed breed"), Cyprus turkeys, Rouen ducks, Aylesbury ducks and Toulouse geese.

The moveable wooden coops are made with 4 sides and a roof ; the floor is simply the ground covered with rice chaff and raised about 20 cm. above the surrounding ground. The floor of the sleeping chamber is covered with peat which is raked over every day and screened once a week. Each fowlhouse has a grass plot about 275 sq. m. The incubators are in a place heated by hot-water apparatus ; as brooders, or foster-mothers, the Canadian type is used ; the brooders are moved from place to place every week.

The director of the establishment, Professor RICCI has already obtained good results by selection : — during the season 1915-1916 he produced Malines cocks weighing 4 to 4.4 kg. at 10 months ; Malines hens weighing 3 kg. ; Rhode Island Red cocks of 4 kg., as a yearly average there were 159 eggs from White Leghorn hens, 148 from Langshans, 135 from White Orpingtons. The mixed breed of fowl, called "Lombardia", was produced by crossing a Houdan cock with a Rhode Island Red hen ; their average weight, before they begin to lay, is 2.6 kg., and they lay about 180 eggs per annum ; the hens have fairly uniform plumage (chiefly dark grey with a whitish collar) ; the cocks, on the other hand, are often variable, which shows that the characters are not yet fixed.

Numerous observations have been made on the subject of the nutrient value of different foods ; the chicks derive great benefit from the use of fish meal, fish-bone meal, and biscuits made of these substances ; as food for laying hens, nettle hay was also useful. As green food the cabbages Express d'Elampes, Oxheart, Afox, Schweinfurth, Quintal d'Alsace, headless Frisé were cultivated ; for the young chicks sorrel and dandelion were chiefly grown. In addition, numerous mulberry trees and American vines gave shade and fruit to the fowls.

963 — **The Improvement of Italian Poultry Rearing.** — CONSOLANI G. (Cattedra ambulante di Agricoltura, Massa Superiore), in *Il Coltivatore*, Year L, XV, Nos. 15-16, pp. 320-323, 3 fig. Casale Monferrato, May 30-June 15, 1919.

For eggs, the author recommends that, in Italy, the common breed should continue to be reared and that it should be improved by selection.

For table purposes, it would be well to use selection with the common breed and also to use exotic improved breeds, rearing them pure or crossing them with the common breed. Among exotic breeds Orpingtons, Faverolles, and Malines fowls are best suited to Italian conditions.

The Orpington fowls, although of somewhat slow growth when very young, reaches a heavy weight when full grown and its flesh is exquisite ; it is at the same time a good layer. Of the two varieties, black and buff, the latter is to be preferred.

The Faverolles fowl is distinguished by the goodness and delicacy of its flesh ; it is earlier than the Orpington and reaches a good weight : furthermore the hens are good layers and excellent brooders.

The Malines fowl is fairly early-maturing ; it reaches a heavy weight, furnishes excellent flesh but does not lay many eggs ; the hens are good brooders, and are well suited to the Italian climate. Of the three varieties, cuckoo, black and white, the first is the best.

17 KEEPING

964 - **Wintering Bees in the United States** (1). — I. PHILLIPS, F. F. and DEMUTH, G. S., *Wintering Bees in Cellars*, U. S. Dept. Agric., *Farmers Bulletin*, No. 1014, 21 pp., 3 fig. Washington, Sept., 1918. — II. PHILLIPS, E. F. and DEMUTH, G. S., *The Preparation of Bees for Outdoor Wintering*, *Farmers' Bulletin* No. 1012, 22 pp., 6 fig. Sept., 1918.

I. WINTERING BEES IN CELLARS. — The wintering of bees in cellars is suitable for localities where, in winter, the outdoor temperature goes down to 15° F.

The hives should be moved to the cellar after the bees have had a good flight late in November or earlier in the more northern localities, and they should be removed in spring as soon as fresh pollen and nectar are available, usually about the end of March.

The cellar should be constructed so that the ceiling is below the frost line and the side walls are not in contact with the outside air. The temperature of the cellar should be regulated so that the minimum temperature within the hives does not fall below 5.0° F. At this temperature there will be little need of special ventilating arrangements. There should be no condensation of moisture within the hives and the cellar should be well drained.

The cellar should always be dark. If it is necessary to examine the hives with a light, it should be done quickly before the bees break cluster. Often in March the door can be opened without disturbing the bees.

If there are dead bees scattered over the floor of the cellar it shows that the bees have flown from the hives, an indication of bad wintering conditions. The bees should be quiet during the late winter. Noise at this season indicates that they are disturbed by an accumulation of faeces caused by low temperature or poor food.

The loss during the winter in a swarm which was in good condition in the autumn and which has wintered in good conditions will never exceed one sixth of its number and may be as low as 1 %. The extent of loss probably depends on the age of the bees. If wintering has taken place in good conditions, when the hives are removed to the open there will be no dysentery, no mouldy combs, there should have been no brood (brood shows that the cellar is too cold or that the food is defective), there is no sensible reduction in the swarm during the first 3 weeks, after which the first new bees of the year begin to emerge.

II. PREPARATION OF BEES FOR OUT-DOOR WINTERING. — The preparation of bees for out-door wintering is of the greatest importance, for it has, more than any other period, a direct influence on the yield of honey in the succeeding year. The hive should be placed in a sheltered place, and the swarms should not be disturbed when the hives are prepared

(1) As regards the wintering of bees in Ontario, Canada, see R., June 1918, No. 670. (Ed.)

for wintering. The authors give instructions regarding the method of arranging the hives to avoid confusion due to moving the hives, the amount and kind of packing, the most economical kind of packing case for enclosing the hives during winter, etc.

965 - **Bee Keeping in the Netherlands.** — FRENAY, P. I. (Beekeeper at Eysden, Netherlands), in *L'Apiculteur*, Year 63, No. 6, pp. 135-139. Paris, June, 1919.

In the Netherlands, few beekeepers own hives of foreign bees preserved pure. In fact, it is only the common honey bee (*Apis mellifica*), which forms the basis of French and Belgian, and generally of all western European hives, that is kept. In the country it is abusively called "German bee", probably because it is the same as that kept in Hanover, Oldenbourg, Luxemburg, Hesse and Lippe, districts where beekeepers have kept up their connection with the Netherlands.

Many beekeepers and scientists consider the indigenous bee of Holland as a special variety called "Heidebei" or heather bee. Dr DATHIE, since 1830, considered the heather bee of Luxemburg (Hanover) as a variety of the common bee distinguished by activity in work and by the fecundity of the queens, and, at the Zoological Congress of Geissen (Hesse), the heather bee was studied, classed as a special variety and christened *Apis mellifica Lehzenii* after the name of the beekeeper G. LEHZEN who brought it to notice.

LANGSTROTH, in his book *Hive and Honey Bee*, mentions the existence of a variety of bee called "the little Dutch" which he said was a small species of the common bee. But, according to the author, the type is not sufficiently characteristic to prove the undoubted existence of a distinct variety.

The country bee, by its qualities, has always proved better than foreign varieties the introduction of which has been often attempted.

The hives present appreciable differences in the size of the workers: sometimes we find hives in which the bees are excessively small (10 to 11 mm. long); we also find, very rarely, those in which the bees are almost as large as Carnolian bees.

The most common type, which may be called the average type, has the characteristics of the common bee: *workers*: — black antennæ; tongue 6.25 — 7.25 mm measured with a glossometer; feet black; hairs on the legs orange; thorax blackish brown; abdomen slightly tapered with three bands of light grey fine down on the 3rd, 4th and 5th abdominal segments; total average length, excluding antennæ, 14 to 15 mm.; spread of wings 20 to 22 mm. The young bees are uniformly light grey, but they soon darken. When older they become glabrous and, in many hives, the first abdominal segments become orange yellow above. The *drones* are much darker in colour than the workers. The *queens*, without any apparent reason, are of two clearly different types; we find almost black queens, slightly larger than the workers and, consequently, rather difficult to distinguish from the latter; we find others much larger, lighter in colour with yellow feet. Many beekeepers prefer the latter queens,

believing them to be more prolific. The author's investigations on this point have not enabled him, up to the present, to come to a definite conclusion one way or the other. At any rate these two types of queen produce workers entirely alike.

The only difference from the common bee is therefore the slightly larger size. This character would not necessarily indicate an improvement in the race and it is necessary to try to explain why the indigenous Netherlands bee is so manifestly superior to the common bee from the point of view of the precocity and fecundity of the queens, of the remarkable industry and hardiness of the worker; and also why they winter so well. The author is of opinion that these qualities come solely from the conditions in which the bees are kept and the climate of the country; the bees, in fact, have had to accustom themselves to the rigour of the climate and to pastoral beekeeping.

No part of the country offers complete resources for bee keeping throughout the whole year. Bee-keepers of the regions of poor land, where the flowering of heather and buckwheat is late, send their hives in March or April to cultivated places and meadows with trees, bringing them back when the fruit trees have finished flowering. On their side the bee-keepers of the cultivated regions send their hives to the heather as soon as it begins to flower, that is to say during the first fortnight in August. Some bee-keepers even move their hives three times.

These journeys, of which at least one takes place in the middle of summer, necessitate travelling 25 to 30 km. by cart as well as some hundred kilometres of railway transit. They continue to use straw hives, cheap and easy to carry and which stand very well the longest and roughest journeys which would be excessively costly and risky for big hives with moveable frames.

The hives generally used are of straw, and are about 30 cm. in diameter inside and 35 cm. in height. Their capacity is about 20 litres. The entrance is at about one third from the top.

Owing to the earliness of the commencement of taking the honey and the precocity and fecundity of the queen, the hive becomes overcrowded very early in the year, sometimes even at the beginning of May. The swarms soon emerge; they are placed in hives of similar kind, where they lose no time in starting their combs. A good hive thus gives 2 to 4 swarms fit to hive in a normal year; the first swarms often give fresh swarms provided the season is somewhat favourable.

The swarms generally do not weigh more than 1 kg.; even those of $\frac{1}{2}$ kg. can be hived. Destined to a certain check if left where they are, their moving to the heather enables them to establish themselves, and often even the late swarms are able to store enough honey to satisfy their needs in the winter. The hives which, at the end of the season, are too light are fed with denatured sugar which is placed by the Government at the disposal of beekeepers in sufficient quantity and at a reasonable price (7.5 kg. of sugar per hive wintered, at about 0.60 fr. per kg.).

The stock and the early swarms often reach a weight of 15 to 20 kg.

Hives treated specially with a view to yield can attain a weight of 25 kg. and even more in a favourable season.

This method of bee-keeping has one great drawback regarding the quality of the honey : at the end of the season the hive inevitably contains much heather honey ; as pressed honey only can be obtained the quality of the product is very inferior.

For this reason many bee-keepers have relegated the production of honey to a secondary place and have established themselves as " swarm makers ". Very great experts in the matter, generally understanding very well the handling of bees and the requirements of bee-keeping on the *fixiste* " system, helped by possessing an eminently hardy race whose queens are prolific and precocious, they have succeeded in getting a first class product. The proof is in the considerable export trade which has been established in the Netherlands, which sends away every year thousands of swarms to England and Germany. Bee-keepers of these neighbouring countries appreciate the superiority of the indigenous Netherlands bee and introduce it regularly in their country to renew their enfeebled stock threatened or attacked by contagious disease, or degenerated by years of in-breeding.

Unfortunately, bees thus produced preserve an exaggerated propensity to swarm and are, in fact, little suited for keeping in large moveable bar-frame hives. However some years of habit and careful selection will eliminate this defect in a great measure.

The Netherlands bee is not aggressive. They generally build their combs very regularly ; the cells are very straight and well arranged. The cells not being filled to excess, the honey does not touch the lid, which gives the slab an agreeable white tint and a fine appearance even when it contains russet honey.

No contagious disease makes ravages in Holland. Foul brood, notably, is quite unknown there in indigenous hives. If, from time to time, German beekeepers have introduced bees infected with this disease, the Government, which efficaciously protects bee keeping, has taken such drastic methods (burning every hive attacked together with the bees, implements, clothes and, in general, everything which might have been infected), that the disease has never spread. Since 1914 (bee keeping relations with Germany having ceased), no case has been reported.

966 - *Sericulture in the Far East*. — Commissioner and Mrs. BOOT-TUCKER, in *The Agricultural Journal of India*, Vol. XIV, Part. I, pp. 140-155. Calcutta, Jan., 1919.

SERICULTURE

Report of an inquiry on sericulture in China, Japan, Korea, Manchuria and French Indo-China, carried out by the authors.

SOUTH CHINA (CANTON). — The variety of silkworm bred at Canton is *polyvoltine* ; it is closely related to the Mysore variety and produces relatively small cocoons but silk of excellent quality. The colour of the cocoons varies, some are slightly greenish like those of the Mysore variety, others are like the Bengal variety in their rich yellow colour, but most are pure white and these are the only kind used for reeled silk for export.

Rearing, reeling, and weaving are all carried out in a primitive manner but with success. No school or technical institution for teaching sericulture exists in the country but the industry is so ancient that everyone engaged in it takes every care and gets very successful results. However, modern filatures have recently been established in the country and seem likely to prosper.

NORTH CHINA. -- The authors visited Shanghai, Peking and Mukden and found there 3 excellent varieties of cocoons called Wusih, Shewshing and Hupeh; according to what local experts said, the cocoons of the Wusih and Shewshing varieties, which are white, are superior in quality to Italian cocoons. Official steps have recently been taken to establish schools for instruction in sericulture in these regions. The authors have imported eggs of the Wusih and Shewshing varieties to Simla (British India) and think that they will be well suited to the Indian climate. The North Chinese silkworms are univoltine and are superior to the polyvoltine varieties of South China. The Chinese filatures use great quantities of the 3 varieties of cocoon above-named, so that silkworm rearing is a profitable industry in these regions. The filatures being generally on the coast the cocoons are transported down the rivers, chiefly down the Yang-tse-Kiang. The Wusih variety is reared in low country where the summer heat is great and the climate is like that of Bengal and the Ganges valley. The Shewshing variety, on the other hand, is reared in a more hilly country at an attitude of about 1000 feet. The Hupeh variety is reared in the interior of China; it produces rich golden yellow cocoons. The authors visited several filatures at Peking and found that they were much more up-to-date than those of Canton.

MANCHURIA. -- The rearing of the variety of silkworm which furnishes the Manchurian tussor has spread from the peninsulas of Liaotung and Shantung eastwards to the valley of the Yalu. The principal commercial centres are now at Chefoo and Antung. Although the Chino-Japanese and the Russo-Japanese wars interrupted the industry, it has recovered since and progress is very rapid and constant.

JAPAN AND KOREA. -- The authors visited the Japanese Imperial Sericultural Institute which has a staff of about 40; the course of instruction lasts 2 to 3 years. Sericulture seems to be better managed in Japan than anywhere else in the world; although the heat in summer is fairly great, the silkworms do not suffer from it.

The silk worms are fed on leaves of bush mulberry only; great care is taken in the plantations which are generally manured and irrigated. The advantage of bushes is that they are much less liable to diseases and pests than trees; it is much easier to pick the leaves from bushes and they can be grown closer together.

Great care, also, is taken to feed the young worms on young leaves keeping the older leaves for the older worms. There are many varieties or kinds of mulberry (200 to 300) and the feeding qualities of some are much better than those of others.

The greatest precautions are taken also to produce sound eggs so

as to avoid the spread of diseases: No one is allowed to produce eggs without a special license and a staff of 3 000 inspectors see that this is observed rigorously. Hibernation of the eggs takes place in caves dug in the sides of hills facing north where a natural current of air from the inside may be expected, this being essential as it maintains a uniform temperature of 30° to 40° F. which is important as the Japanese have two harvests of cocoons, one in the summer and the other in autumn. The eggs for both are of the univoltine variety and are of the previous year's layings.

In Korea the Japanese have made great efforts for the extension of sericulture and have already obtained results which give good prospects.

In Japan, the Government has helped greatly by the establishment of schools; there are 2 sericultural institutes supported by Government, one at Tokio and the other at Kioto; sericultural schools have been established, some in the different Prefectures and others in various counties; there are also several private institutes. Agricultural colleges, Forestry schools and Agricultural Experimental Stations also deal with sericulture. Technical lecturers are sent round by Government in various provinces, and numerous competitions and exhibitions are organised every year.

The government also takes an interest in the cultivation of the mulberry, which, in 1907, occupied 7.44 % of the total area under cultivation in the country, and in the best methods for preventing disease. A "conditioning house" has been established by law; in 1908 the number of tests performed in the silk conditioning house amounted to no less than 97 723. There are also numerous sericultural associations and credit co-operative societies.

FRENCH INDO-CHINA. — After having imported unsuccessfully the French univoltine variety of silkworm which did not stand the tropical climate, the French tried, again unsuccessfully, a cross between it and the indigenous silk worm. But good results were obtained by improvement, under selection, of the indigenous polyvoltine variety, which closely resembles the Canton and Mysore varieties.

The principal conclusion, which the authors have come to after their inquiry into sericulture in the Far East, is that it would be possible to rear polyvoltine varieties in tropical plains such as Bengal and Madras practically all the year round; success in such rearing depends chiefly on the proper cultivation of the mulberry, irrigated where necessary, which would enable the worms to be fed always with fresh leaves.

FARM ENGINEERING

967 - **Notes on tractors.** — RINGELMANN, MAX, in *Annales de l'Institut National Agronomique*, 2nd Series, Vol. XIII, Pt. 2, pp. 247-274. Paris, 1918.

As results of trials made in 1914, 1915, 1916 and 1917 (1), in which 65 machines took part, the author states a certain number of conclusions of which the principal are as follows: —

(1) Tests at Grignon, Trappes, Neuville, Grigny, Chevry-Cossigny, Brie-Comte-Robert, Bertrandfosse, Gournay-sur-Marne, Provins and Nohy-le-Grand. See R., Jan., 1915, No. 90; R., August, 1915, No. 843; R., Nov., 1917, No. 1051. (Ed.)

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

Direct tractors should not weigh more than 2 800 to 3 000 kg.; these very handy machines give an average tractive effort* of 600 to 700 kg.

With a greater average tractive effort than 600 to 700 kg. the frame becomes distorted and the connections cannot last on the uneven ground of fields; the axles become bent and other parts of the machinery deranged, entailing a greater consumption of fuel and rapid wear.

When the work to be done, owing to its nature (clearing, digging, etc.), or owing to its amount (depth and width of the tilth), requires a tractive effort of more than 600 to 700 kg., direct tractors must be abandoned and cable and windlass traction adopted.

For good steering, about one third of the total weight of the tractor should be borne by the steering wheels and two thirds by the driving wheels. Two steering wheels work better than a single one.

The weight of tractors, in proportion to the length of the generatrix of the wheels, should not exceed 30 to 35 kg. per centimeter of width of the tyre (these figures, obtained from tests previous to 1913-14, were confirmed in 1915, 1916 and in tests made in 1917). The width of the tyres should not be too exaggerated.

Nothing is gained by too great an increase in the diameters of the driving wheels; it appears that the diameter should lie between 1.10 m. and 1.40 m.

In the case of external transmission to the driving wheel or wheels (by gearing or chains), it is desirable to have a space of at least 25 to 30 cm. between the ground level and the lowest point of the transmission or of its case.

It is desirable to do without a speed gear and to use a single driving wheel or two wheels close together that can be disconnected individually when turning. With one wheel running in the furrow and another on the grassland the speed gear works constantly on one side and one of its gears wears out much more rapidly than the other.

The use of ridgers is strongly recommended. Of the land-grips attached to the rims of driving wheels, angle irons and strakes spoil the ground less than spikes and ridges which compress strongly parts of their imprint in the ground. The strakes or angle irons should pass over the unworked ground; the subsequent turning over of the strip of ground breaks up the parts which have been compressed on the grassland, which would not be the case if the driving wheels pressed on the bottom of the furrow; in this latter case the compressed portions covered up by the next passage of the plough which hides them remain in that state and in some soils these portions remain for a long while in the state of very hard blocks; this defect does not occur in sandy soils.

If necessary, a steering wheel may run in the furrow, but it is better to avoid this arrangement.

There should be a space of about 20 cm between the edge of the wheels and the side of the frameplate.

For ordinary work it is preferable to use motors of not more than 20

to 25 horse power, of high angular speed, with several cylinders of the automobile type which can easily be started.

The circulation pump, if used, should be driven by gearing ; the fan should be belt-driven.

The tractor should always be fitted with a brake.

The use of chain tracks (caterpillars) is inadvisable on account of their high consumption, the difficulty of steering them and because their numerous joints wear out quickly.

Fore-wheel tractors behave almost like motor ploughs ; their steering by the driving wheels is very difficult on account of the pressure which they bring to bear on the ground, especially if one wheel armed with land-grips runs in the furrow.

Driving automobile wheel ploughs is very difficult.

The double brabant plough worked by windlass, one of which was tested, is an interesting machine to small farmers. With an utilisable average tractive effort of 600 to 700 kg., the speed can be increased up to a limit of nearly 4 000 m. per hour (1.10 m. per second), above which steering becomes difficult and the traction of the cultivating implement becomes too great ; a speed of about 3 000 m. per hour (about 80 cm. per second) seems preferable.

In the same conditions (season, day, soil, plough and work) traction increases from 100 to 118 while the speed of the plough increases from 1 to 2.5.

A tractor commences to be useful practically when the furrows are about 150 m. long.

The average time taken to turn is about half a minute ; exceptionally a good driver will turn in 20 seconds, while an unskilled and unpractised workman may take a minute.

Two men are required for the work ; a driver on the tractor and an assistant. The employment of the assistant, who sits on a seat carried by the plough or other implement, does not do away with the necessity for automatic lifting.

Scarcely more than 50 minutes useful work per hour can be expected. It is a good thing to interpose a coupling between the tractor and the plough, or other implement. The author's investigations published in 1893, which have since been several times confirmed, show that the use of a well arranged coupling saved 33 to 54 % of starting effort and 10 to 30 % of average tractive effort. For tractors this saving only affects the portion of their hourly consumption which corresponds with the average tractive effort, while reducing the wear of the machinery (1).

For ploughing before autumn sowing and for spring ploughing it is very useful to attach a harrow to the plough.

The great advantage of a tractor comes from the area it can work over

(1) See the article by the author on couplings for tractors summarised in *R*, Dec. 1918, No. 1399. (*Ed.*)

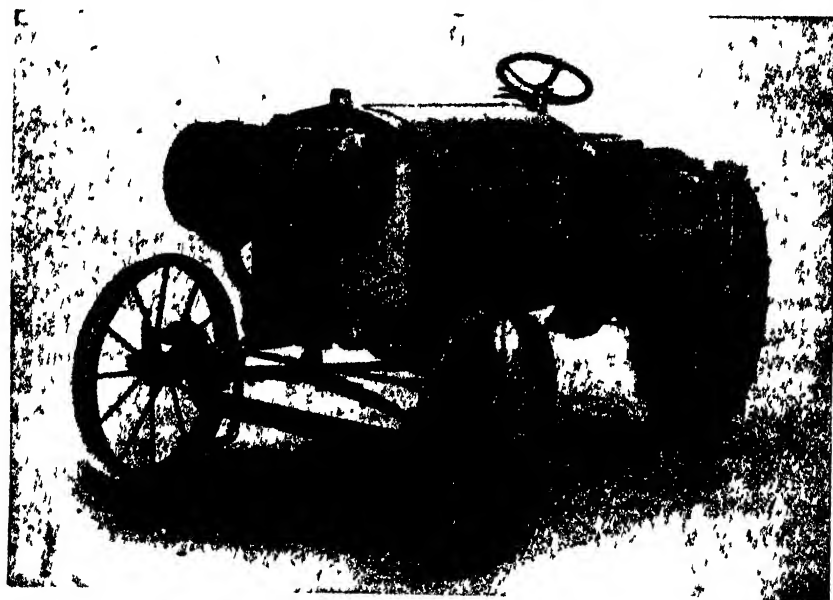
per hour, thus making it possible for the farmer to get his work done when he wants it.

It is desirable to reduce as much as possible moving by road, at any rate to remove the land-grips from the driving wheels or to adopt a special method of moving or an arrangement by which the tractor can quickly be got ready for running on a road without the necessity of unbolting the angle-irons, strakes, etc., on the driving wheels. A tractor is economically useful on an area with a radius of 1000 to 1500 m., on fields where the slope is not greater than 7 to 10 %.

968 - **The Garner Tractor** — *The Implement and Machinery Review*, Vol 45, No 530, pp 234, 111g London, June 1, 1919

The "Garner" tractor derives its title from the fact that it is placed upon the market by Messrs. Henry Garner, Ltd., Mosely Motor Works, Birmingham. It is of the four-wheel type, the two front wheels steering. The engine, flywheel housing, three-speed gear box and rear axle are all firmly bolted together.

A small frame, fitted to the engine bearers, and carried round the front, forms a central pivot for the front axle and transverse spring. The four-cylinder engine, cast in one piece, has a 4 1/2 in bore, with a stroke of 5 1/2 in. It develops 28 9 H. P., and the governed speed can be varied from 900 to 1200 revolutions per minute. The carburetter is designed to start on petrol, and run on paraffin, and the ignition is by high tension magneto. A radiator of large capacity secures efficient cooling under all working



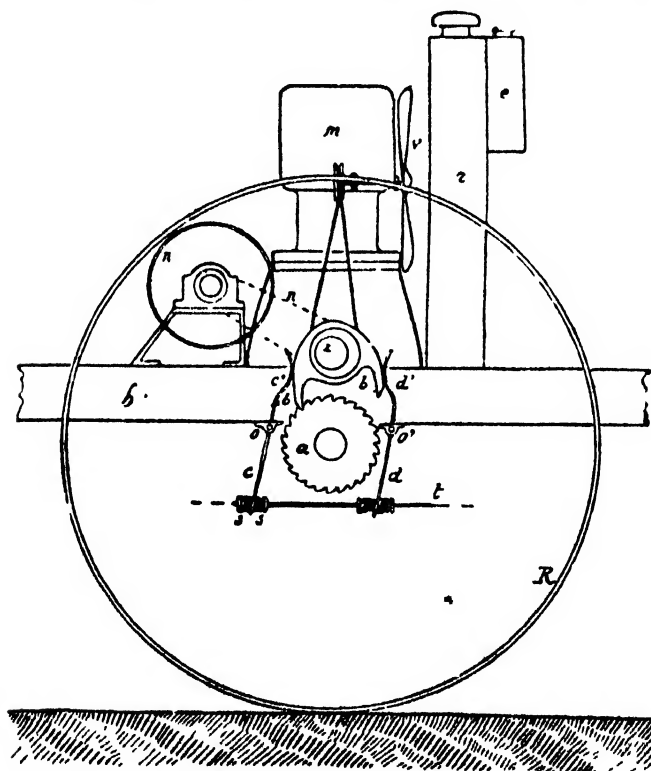
GARNER tractor.

conditions. The clutch is operated by a foot pedal, and though totally enclosed, is accessible by means of the large inspection cover provided. The clutch takes up the load gradually. Three speeds — of $1\frac{1}{2}$, $2\frac{3}{4}$ and 5 miles per hour — and a reverse are provided. The rear wheels, which have a diameter of 40 in. and a width of 10 in., are fitted with easily detachable spuds; whilst the front wheels are of 30 in. diameter. Internal expanding brakes act directly on the rear wheels, and are operated by foot pedals; whilst a front transverse spring enables the machine to be used on the roads and also acts as a shock absorber. A pulley is mounted on the gear-box for stationary work, for driving threshing machinery, etc.

The total weight of the tractor is 34 cwt. Its maximum height is 5 ft. 1 in., and its overall length 10 ft. 6 in. The "Garner" can operate a three or four furrow plough on ordinary land and a two or three furrow implement on stiff land.

969 - **The Decouan Pawl and Ratchet Tractor.** — RINGELMANN, MAX, in *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year CXVIII, 1st Half-Year, Vol CXXXI, No 2, pp 375 376 Paris, March-April, 1919.

While he was a prisoner of war in Germany, M. GEORGES DECOUAN,



Principle of the DECOUAN pawl and ratchet tractor.

of 17 rue Montmartre, Paris, studied transmission from the motor to the driving wheels of a tractor. He tried to do away with the gearing in the gear case, speed gear and transmission by chain or by cogwheel to the driving wheels.

The nave of each driving wheel R (fig.) is in one with a ratchet wheel *a* which is pushed forward by pawls *b* fixed on an eccentric *r* on the shaft of the motor *m* (the radiator is indicated by *r*, the fan by *v*, the fuel tank by *c* and the frame by *h*). There should be 3 pawls whose eccentrics are fixed at 120 degrees so that one would always be in action, thus ensuring as uniform movement as possible.

For turning, the action of the pawls on the nave of the wheel which is towards the turning centre can be stopped, or for turning in its own length one wheel is driven forward and the other backwards. Reversed action is obtained by inclining the pawls *b* by the connecting rod *r* moving by the abutments and springs of the arms *cc'* and *dd'* round the axes *o* and *o'*; the pawls *b'* then come into action on ratchet wheels similar to *a* but with teeth inclined in the opposite direction.

The speed can be regulated by an arrangement changing the course of the pawls *b* which engage at each oscillation one or more of the teeth of the ratchet wheel *a*, as is done in the old drilling machines. At *nn'* is a transmitting pulley with a shaft carrying pulleys for working various machines with a belt.

970 - **The Gianetti Motor cultivator and its Uses, Especially in Rice Fields.** —

I. TARCHETTI A., in *L'Italia agricola*, Year LVI, No 7, pp. 210-217 + 5 fig. Piacenza, July 1919. — II. *Il Giornale di Agricoltura*, Year IX, No. 5, pp. 78-79. Vercelli, May 31 1919.

The following disadvantages are charged against the common plough: -- (1) The soil is turned over but not crumbled; (2) there are, in the lower part of the ploughed layer, large spaces between the greatly packed clods of earth, which prevent regular diffusion of moisture; (3) the bottom of the furrow remains compressed over its entire length; this compression increases each year forming under the ploughed layer a very hard surface, impermeable to water and which roots can scarcely penetrate; (4) in gravelly soil the plough cannot be used, or it breaks, or at any rate it quickly wears out.

These drawbacks are entirely avoided by digging the ground with a spade, which turns and breaks up the earth. Consequently a number of machines working after the manner of the hand spade have been invented, such as disc ploughs, screw ploughs, rotary ploughs.

Rotary ploughs can be divided into 3 groups according to the form of the working parts: -- Machines with rigid implements; machines with rigid but jointed implements; machines with flexible implements. Experts have a decided preference for rotary ploughs with flexible implements and more particularly for those with claws of the MEYENBURG type.

MEYENBURG'S motor-cultivator (1) is now made in Italy by the firm of GIULIO GIANETTI (2) of Saronno (Province of Milan), which has carried out important tests at Saronno and Vercelli.

GIANNETTI'S motor-cultivator is composed of an ordinary 3 wheeled tractor (one front steering wheel and two driving wheels) worked by a 4 cylinder petrol motor, 22 H.P. 1000 revolutions; it has three speeds, 1.6 km — 2 km — 3.5 km per hour respectively and a reversed speed of 1.5 km per hour; it weighs 2000 kg.

The same firm also makes three other types; two hand driven with motors of 5 and 8 H.P. respectively, and the third made as here described but with a 32 H.P. motor. The 22 H.P. type tested by the author is the best adapted for rice fields in the Province of Novara.

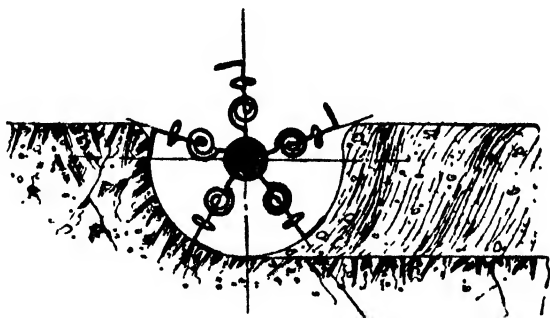


Fig. 1. — Work of MEYENBURG's rotary plough.

The driving shaft can transmit motion to a rotary cultivator (placed behind the driving wheels and parallel to them) composed of 32 strong steel springs each ending in a sharp hook (15 mm. in diameter) which works like a pick and which is easily attached or detached when it is necessary to replace it. These springs are fixed and are distributed evenly in 8 planes (consequently 4 radiating springs in each plane) on the shaft carrying them, and thus form, collectively, a kind of cylindrical reel ("aspo"), measuring about 0.60 m. in diameter and 1.30 m. in length. According to the speed, this cultivator will work 2000 — 2600 — 4500 sq. m. an hour, but, in practice, the result is a little less because only 1.20 m. of the length of the "aspo" is used as the width of ground worked.

The whole of the working parts can be raised or lowered at will by the driver, and the depth to which the claws penetrate the ground (up to 28 cm.) is regulated by means of a system of springs acting on the axis.

The whole of the working parts is covered at the sides and top by strong canvas cases, which protect them from the thrown up earth and

(1) See *R.*, June 1913, p. 855 and fig. 6; *R.*, August 1913, No. 972; *R.*, Jan. 1914, No. 52. — (2) Patented by the *La Motoculture Française* Company, formerly Mayenburg of Basel. (Ed.)

allows easy inspection of the rotary part; at the back the canvas is replaced by a grating, the height of which can be regulated, which allows a certain amount of freedom in the rotation of the hooks and only holds back the larger and heavier pieces of slashed earth while leveling the surface of the soil like a rake.

As the tests at Saronno and Vercelli have shown, the machine works perfectly in gravelly and manured land; when ploughing up stubble the straw is not buried, but is cut up and spread evenly over the whole area of the ground ploughed. Against couch grass it has no effect. When clearing old grass lands, to get perfect results, the motor-cultivator must go over the ground twice, because a single ploughing does not break up the matted roots sufficiently. Very heavy soils should also be worked over twice.

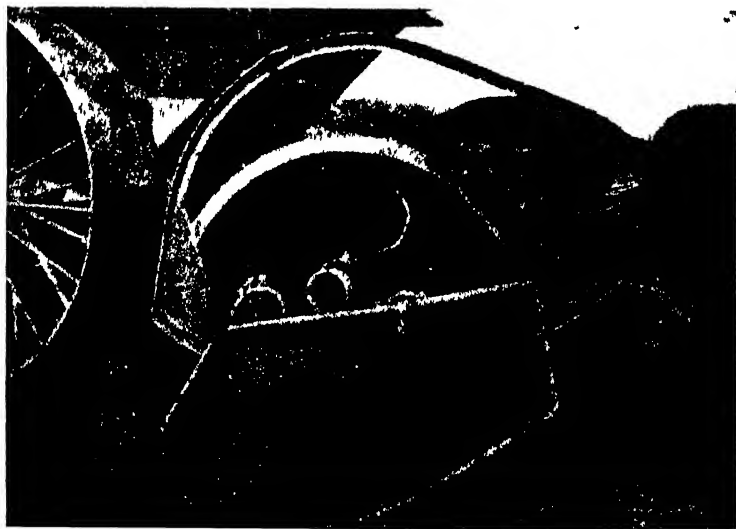


Fig. 2. — The rotary part of the GIANETTI motocultivator, open.

It is complained that excessive breaking up of the soil has some drawbacks such as: — (1) stopping the development of microbes, ferments, and chemical action; (2) the formation, in clay soils, of an impermeable superficial crust after heavy rain of short duration; (3) the formation of a very hard plane under the layer worked; (4) in moist ground, the formation of a fine layer of small balls of earth which the roots cannot penetrate.

Considering the matter from the point of view of rice cultivation, the author, relying partly on the results of the Vercelli tests maintains, on the contrary, that: — (1) excessive breaking up of the soil is useful because

it destroys enormous numbers of agricultural pests (earthworms, larvae of cockchafers, mole crickets, etc.); (2) the formation of a crust caused by heavy rain can only be injurious during the period of germination, in which case the crust can be broken up by a very light harrowing; (3) the very hard plane under the worked layer might be formed (as happens in ordinary ploughing) when using a rotary cultivator with rigid spatula-shaped implements which successively take up the whole width of the worked strip, but not when using the MEYENBURG rotary machine with hooks quite separate from each other. At the Vercelli trial it was noted that, under the worked earth, the bottom was neither a plane surface nor hardened, but slightly undulating.

The author notes that, when judging the effect of the work of the rotary plough on the crop, it is not enough to consider the results of a single year, that is to say obtained on land which up to that time had been worked with ordinary ploughing, but that the judgment should be based on the results of a series of years during which the soil has been tilled regularly with the motor-cultivator.

Finally, the author goes into various questions relating to the effect of the work of the rotary plough in rice fields which had to be solved experimentally, and he expresses his conviction "that the new technique is marvellously adapted, in many respects, to the economic conditions of work and cultivation of rice fields".

II. The following opinion is expressed on the machine under review:—

"The motor-cultivator does not plough the land but breaks it up completely, that is to say it unites to the functions of the plough those of the harrow and the rake, but in an extremely forcible and complete manner. After the passage of the motor-cultivator, the soil is more mellow than the best gardener could make it; the top layer is finely broken up, turned up and turned over and this to a depth of about 30 cm.; there results a layer of earth minutely and evenly crumbled and levelled as if a roller had passed over it".

971 — **The Warwick Patent Spiral Tiller.** — *The Implement and Machinery Review*, Vol. 45, No. 530, p. 326, 1 fig. London, June 1, 1919.

The "Warwick" Patent Spiral Tiller is placed upon the market by the Eagle Engineering Co., Ltd., Eagle Works, Warwick. The tool is described as a substitute for the garden rake, hoe and scarifier. As shown in the accompanying illustration, it consists of a series of spiral coils, which gives the implement a drilling action when breaking up the soil. It can be used for preparing seed beds after the ground has been roughly dug. Owing to its particular spiral design, the soil is quickly broken up to the depth required according to the pressure exerted, leaving an even, smooth surface for planting. A great advantage claimed for the tiller is that when drawn backwards and forwards over the soil it thoroughly pulverises hard and large pieces of earth. The "Warwick" is considered especially suitable for preparing lawns for seeding and for work usually accomplished

by the aid of a garden rake. Operating as a hoe, it has been found to act with great success, uprooting weeds and leaving a smooth ground surface.



Waiwick Patent spiral tiller

972 - **One-Handed Spade.**— *Revue scientifique*, Year LVII, No 13, p 408 Paris, July, 1919.

M. BESSONNET FAVRE, a maker in the department of Vienne France, has invented a spade, for persons who have lost one hand or one arm, which can be used with one hand.

It is naturally forced into the ground by the foot ; when it has reached the required depth the end of an arc of a sector jointed at its centre which the socket of the spade comes into contact with the ground. The arc forms a fulcrum which enables the sod to be raised by pressure at the end of the handle and the sod can then be turned over by a turn of the hand.

973 - **Review of Patents.** — Sources : — CANADA, DENMARK, UNITED STATES, NEW-ZEALAND, UNITED KINGDOM, NETHERLANDS, SWITZERLAND, See A, Jan 1919, No 104 — FRANCE, see R, Febr. 1919, No. 247. — BRITISH INDIA, see R., May 1919 No. 630.

TILLAGE MACHINES AND IMPLEMENTS. — *Canada*: 190398 Garden implement with interchangeable working parts (hoe, rake, etc).

Denmark: 24788 Rake ; 24805 Regulating device for motorplough.

France: 491092 Arrangement for regulating the height of a plough or other similar agricultural machine relatively to, at least, one of the wheels ; 491330 Tractor plough, 491477 Improvements to ploughs ; 491568 Motor tractor for general agricultural purposes and specially for vineyards and weeded crops, with special arrangement for making it suitable for ploughing and cultivating implements ; 491787 Improvements for double ploughs.

Netherlands: 3272 Wheel with land-grips for motor plough.

United Kingdom: 124847-125377 Motor ploughs ; 125245 Hoe.

United States : 1299435 Plough accessory; 1299676-1300596-1301116-1301268-1401557 Cultivators; 1300392 Plough self-lifting device; 1300824-1301627-1301724 Disc ploughs; 1301043. Mechanical plough; 1301063-1301539-1301540-1301724 Ploughs; 1301226 Harrow; 1301384 Toothed pulveriser; 1301443 Combined harrow and pulveriser.

Switzerland : 81721 Hoe.

MANURES AND MANURE DISTRIBUTORS. — *Canada* : 190593 Fertiliser distributor.

Denmark : 24792 Apparatus for loading and transporting manure.

France : 491321 Improvements in manure spreading machines; 491227 Nitrogenous organic vegetable manure (spent tan placed in contact with organic matter, in the form of compost, which nitrify rapidly).

United Kingdom : 124946 Process and apparatus for removing free acid contained in crystallised sulphate of ammonia.

United States : 1300791 Manure spreader.

DRILLS AND SEEDING MACHINES. — *Denmark* : 24332-24407 Potato planters; 24461-24550 Seeders, 24726 Arrangement for seeder.

Netherlands : 3223 Broadcast seeder.

United Kingdom : 124890 Distributor for seeder 124937 Potato planter.

United States : 1299626 Seeder; 1299652 - 1300419 Potato planters; 1300641-1301214 Seeders for maize; 1301291 Detail of potato planter.

VARIOUS CULTURAL OPERATIONS. — *Canada* : 190398 Garden implement with interchangeable working parts (hoe, rake, etc).

Denmark : 24777 Weeder.

France : 491568 Motor tractor for vineyards and weeded crops.

Switzerland : 81721 Hoe.

United Kingdom : 125 245 Hoe.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Canada* : 190496 Trap for insect pests of potatoes.

Denmark : 24611 Trap for animal pests; 24671 Apparatus for capturing insects in fields of beet, cabbage, etc.

France : 491348 Arrangement for the destruction of weeds by artificial heat.

Switzerland : 81725 Nozzle for watering plants.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Denmark* : 24755 Support for drying plants and cereals.

France : 491545 Haymaker; 491624 Flax puller.

Netherlands : 3177 Mower with revolving blades.

Switzerland : 81722 Machine for forging scythes.

United States : 1299599 Binder; 1299685-1301512 Dividers for reapers; 1299686 Device for regulating the platform of a reaper; 1300907 Mower; 1301289 Reaper; 1301361 Reaper and thresher.

MACHINES FOR LIFTING ROOT CROPS. — *Denmark* : 24446 Beet lifter and toppler; 24547-24557 Machines for harvesting and sacking potatoes; 24610-24620-24725-24754 Beet lifters; 24765 Potato digger.

France : 491176 Beet harvester.

basis for the future development of the agricultural industry can be arrived at.

The Committee proposes to assist farmers who already keep accounts in the difficult work of recording the costs and profits of farming operations generally, and of particular kinds of produce, for instance, meat, milk, cereals and potatoes. It is also hoped to induce other farmers who have not hitherto kept books to do so, and to give them assistance on similar lines, so that detailed information as to costings may be obtained on an extensive scale. The information so obtained will, it is hoped, be available for the use of the Committee's records of the costs of production, etc. and will be of great use in promoting the welfare of the industry generally and also to the farmer himself. All such records will be collected and centralised so that the average costs for a given district or product may be ascertained and economic and statistical data of permanent value may be compiled. The farms by which cost data are provided will be denoted in the records of the Committee by a number or letter only. The information will be treated in the strictest confidence and will be available for the assistance of farmers generally, but only under the strictest anonymity. The information which it is hoped to collect and analyse should be of practical value to the individual farmer. He will no longer be in ignorance of the actual results of the various departments of his farm; he will be able to see which of his operations are remunerative and to concentrate on those departments which pay him best; his farming methods and system can be varied as far as is practicable and consistent with good husbandry; he can compare his own costs of a particular crop or product with the average cost in the district and investigate the reason for any abnormal charges in his own case.

In these and other ways the information should promote efficiency and economy and augment the profit-earning capacity of the farm.

Data will be available which will facilitate the consideration of questions affecting wages. Further, should any question arise affecting the control of prices, etc., proper records of ascertained facts will be in existence. The farmer will have information which will facilitate the adjustment of income tax problems, and the production of proper accounts in many cases improves credit where financial assistance is sought.

There appears to be no question, therefore, that the industry will be in a stronger position with proper and proved statistics than without these as hitherto.

The Committee realises that success in the work will be dependent on the goodwill and co-operation of the farmers and it will as far as possible assist in the work which it asks of them. Certain records in addition to financial records will have to be kept by the farmers *e. g.* time records, food consumption records, and manure records, in as simple a form as possible. The necessary tabulating and balancing will be assisted in by the committee's staff.

The Committee desires to get in touch with farmers who keep accounts for their farms or who are interested in farm accounts, and communica-

tions should be addressed to the Director, Room 247, Palace Chambers, Westminster, London, S. W. 1, who will be pleased to furnish any information desired.

976 - Agricultural Costings Studies in the United States. — (*Report of Committee Appointed by the Secretary of Agriculture: To consider Plan of Organisation, Scope of Work, Projects for the Office of Farm Management, and Methods of Procedure in Making Cost of Production Studies*) — U. S. Dept. of Agric., Circular 132, Office of the Secretary, pp. 1-15, Washington, D. C., Murch, 1919.

Upon the request of the Secretary of Agriculture a Committee consisting of leading men in farm management and agricultural economics from the State agricultural colleges and the National Farm Management Association has given active assistance in suggesting and outlining future work for the Office of Farm Management. This Committee was asked to consider a broader and more clearly defined field of operations for the Office of Farm Management, to determine the co-operative relationships that should exist between Federal and State investigators, and to outline methods of procedure in developing projects and especially in determining the cost of production of agricultural products.

The report of the Committee was presented in person to the Secretary of Agriculture on February 26. The Secretary approved the recommendations and states that the projects proposed could be started and carried out in large part with available funds and that the work should be pushed as rapidly and vigorously as possible.

The Secretary will submit to Congress the new plan of organisation and ask for authorisation to establish a "Bureau of Farm Management and Farm Economics" and that additional and adequate funds be provided to place these important activities on a broad and satisfactory basis. Dr. H. C. Taylor, head of the Department of Agricultural Economics in the College of Agriculture, University of Wisconsin, was appointed by the Secretary of Agriculture as Chief of the Office of Farm Management, United States Department of Agriculture.

Organisation and projects. — The work of the proposed "Bureau of Farm Management and Farm Economics", — according to the Committee's report, could well be organised around the following projects (p. 984). The nature of the work under these various projects is indicated by the names of a few sub-projects proposed.

Co-operative relationships. — The Committee has recommended that the investigations of the Office of Farm Management requiring field work be carried on in co-operation with the State colleges and experiment stations. Some of the benefits of such cooperation would be :—

1. To prevent duplication and to correlate activities.
2. To promote the development of State departments.
3. To unify the methods and improve the general character of all farm management work.

Cost of production studies. — Cost of production studies, according to the Committee, are of value to the individual farmer and at the same time are helpful in ascertaining the economic status of farming as an industry.

- | | |
|--|-------------------------------|
| ADMINISTRATION] | A. — BUSINESS OFFICE |
| | B. — RESEARCH WORK:— |
| | 1. <i>Cost of production.</i> |
| | a) Financial records. |
| | b) Enterprise records. |
| | c) Complete cost records. |
| | d) Price relations. |
| | e) Basic unit factors. |
| | 2. <i>Farm organisation.</i> |
| | a) Farm business analysis. |
| b) Farm practice. | |
| c) Effective use of labour and equipment. | |
| 3. <i>Farm finance.</i> | |
| a) Methods of financing. | |
| b) Insurance. | |
| c) Taxation. | |
| 4. <i>Farm labour.</i> | |
| a) Supply and movement | |
| b) Trend of population. | |
| c) Living and housing problems. | |
| d) Creating new productive enterprises for farm labour. | |
| e) Standards of supervision and compensation for farm labour. | |
| 5. <i>Agricultural history and geography.</i> | |
| a) Trend of agricultural development. | |
| b) Shifts of agricultural production. | |
| c) Relation of American to foreign agriculture. | |
| d) Supervision of Atlas. | |
| 6. <i>Land utilisation.</i> | |
| a) Land resources and utilisation. | |
| b) Land settlement. | |
| c) Land ownership and tenancy. | |
| 7. <i>Farm life studies.</i> | |
| a) Co-operation and trend of co-operative movements as affecting the farmer's life and activities on the farm. | |
| b) Agricultural relations to other industries. | |
| c) Agriculture for industrial workers. | |
| d) Conditions of farm life as affecting national welfare. | |
| C. — EXTENSION WORK: | |
| a) Publications and illustrative material. | |
| b) Farm management demonstrations. | |
| c) Farm labour supply. | |
| d) Other farm economics demonstrations. | |
- PERSONNEL:
- Chief
- and
- Assistant Chief.
- FUNCTION:
- Planning
- the work.
- Supervision.
- Correlation.
- Editorial.

Their results for a number of farms where a given type of farming is practiced are useful not only to the farmers from whose farms the results were obtained, but are of value in showing other farmers how to improve their methods. From the standpoint of the public, cost of production studies provide the facts which give a basis for intelligent judgment upon the probable effects of any given legislation or other public activity upon the farmer as a producer and as a citizen. Cost of production studies are, therefore, one of the means of providing the basic facts needed by

legislators and price commissions in comparing the profits of competing lines of production and estimating necessary prices.

The Committee's Report gives a brief outline of the methods of cost investigations proposed, consisting of cost accountings, survey methods and questionnaires sent by post. The accounting method is based on complete records of all farm work and business transactions. Arrangements are made with farmers to keep detailed records of all operations and transactions in connection with the farm business. The work is supervised by personal visits to the farm. Cumulative results of such work (farm accounting statistics) become increasingly valuable.

By the survey method the necessary data are obtained from farmers by trained investigators. Some of the data are taken from the farmer's books; some from the books of persons to whom the farmer sells and from whom he buys; some from his bin, silo, and building capacities; and some of the data are based on estimates made by the farmer.

Some of the advantages of the survey method are:—(1) it is a relatively inexpensive method of securing records from large numbers of farms; (2) records are obtained from all classes of farms; and (3) records are obtained after the close of the farm year, so that, when desired, areas more representative of normal conditions may be chosen. By the survey method it is sometimes difficult to determine the amount of general expense and miscellaneous labour, and the proper basis for apportioning such items to different enterprises. Unless the investigator is thoroughly experienced in the subject that he is studying, some items of importance may be omitted.

Both methods are useful and reliable when the work is carefully conducted. Either method may be used, but preferably both should be used. The detailed cost accounts serve as a check on the survey work, and the survey work shows the relationship of the farms on which cost accounts are kept to the average farm. The questionnaires sent by post can be used to advantage in securing supplementary data from large number of farmers. To secure the best results the questionnaire should cover only a limited number of cost items and the questions should be direct and clear. A detailed grouping of cost items is suggested by the Committee for the farm cost accounting work.

977 — **Cost and Receipts of Banana Cultivation in Columbia** — See No. 912 of this *Review*

978 — **Cost of Creating and Receipts from a Vineyard of Stoneless Grapes for Drying, in California.** — See No. 915 of this *Review*.

979 — **Results of Statistics of Farm Accounts in Denmark during the Year 1916-17.** — LARGEN, Prof. H. O., in *Nordisk Jordbrugsforskning* Year I, Part 2, pp. 52-59. Copenhagen, 1919.

The Danish Societies for the study of farming economy ("Land-økonomiske Foreninger") had, in 1918, about 220 farms inscribed in these societies which furnished accounts for the year 1916-1917 for statistical purposes. There were, however, in that year 707 farms, representing

an area of 27 000 hectares inscribed in the 25 accounts offices of their respective districts. These offices receive from the State a contribution for the pay of the technical and accounting staff.

One third of these 220 farms were in Jutland and two thirds in the islands and they were, for the greater part, owned by the farmers. The accounting methods used were the same as those adopted in 1913 by the Royal Danish Society of Rural Economy.

LOCAL DATA. -- The 6 accounting offices in Jutland dealt with 18 farms. As it was chiefly a matter of farms cultivated by their proprietors, the balance sheets were made out so as to show clearly the net receipts of the farmer, that is to say they took into consideration the interest on capital, the cost of work done by the owner and his family, and the profits. The net revenue averaged, for all the farms, 400 fr. per ha., with differences, for the various accounting offices, of from 313 to 502 fr. per ha. On the other hand, for individual farms the differences were from 48 to 1 425 fr. per ha.

Only 2 accounting offices calculated the remuneration of capital, which was 8.8 % on an average for 24 farms in Kolding Herreds, and 9.4 % for 11 farms in Kolding Omegns.

The statistical elaboration of the accounting data include, as well, the examination of yields of crops and livestock.

For the islands the data were published in reports of the accounting office of the Agricultural Society for Sjaelland and in those of the accounting offices of Copenhagen and Odense. Table I shows the net revenue of these farms arranged according to size.

TABLE I. *Net yield and yield per cent for farms in Odense, Omegns, Landbol, arranged according to area. Results for the year 1916 1917.*

Area class	Number of farms in each class	Average area hectares	Total capital per hectare	Yield of the farm per hectare	Yield per cent
Under 25 hectares	6	19.2	1 172 fr	346 fr	8.32 %
25 to 50 "	18	35.6	4 032	332	8.24
50 to 100 "	10	65.6	3 489	225	6.46
Over 100	4	216.8	2 961	273	9.25
<i>Totals and averages</i>	38	60.3	3 473 fr	280 fr.	8.06 %

For 3 accounting offices, dealing with 125 farms, the average land capital per ha. varied between 2 429 fr. and 3 473 fr., and the average net yield (difference between the gross yield and the working expenses, including taxes and management) varied between 250 fr. and 280 fr. per ha. The yield per cent varied between 8.1 and 10.3 % for the different groups; the variations between individual farms are much greater. These variations are partly explained by the small amount of homogeneity in the groups regarding the number of farms in each group.

Table II shows the best economic results of the farms during the period of the war —

TABLE II. — *Economic results of farms during the war.*

	Number of farms	Average area of the farms	Total capital per ha	Net yield of the farms per ha	Yield per cent
1914-1915	25	46.5 ha	2 893 fr	220 fr	7.67 %
1915-1916	34	49.7	3 422	377	11.00
1916-1917	38	60.3	3 473	280	8.06

GENERAL DATA — The central office for statistics of agricultural accounts has for the first time worked up the data collected by each accounting office in 1918.

This central office of rural economics, the chief work of which is to elaborate the statistical data of agricultural accounts, was founded by the Royal Danish Society of rural economics.

The office is managed by a committee chosen from the representatives of the principal agricultural societies, of trade councils and of the statistical department.

After 3 years preliminary work, the office commenced work in the spring of 1918 and the first results appeared in the autumn of that year. These results include the statistical elaboration of accounts documents received from 75 farms, of which 27 were in Jutland and 48 in the islands.

The local accounting offices also made use of the accounts for publications and for research of a local character, but the work of the central office has been more complete and contains data regarding prices of crops and agricultural produce as well as quantities.

The principal results of the statistical work relating to these 75 farms, for the year 1916-1917, are set forth in Table III.

TABLE III — *Accounts results of 75 farms for the year 1916-1917.*

Area classes	Number of farms	Total capital per ha	Gross yield per ha	Working expenses per ha	Net yield per ha	Yield per cent
Under 20 hectares	16	3 189 fr	1 323 fr	1 004 fr.	319 fr	9.1 %
20-30 "	23	3 428	1 177	861	318	9.3
30-50 "	20	3 303	1 038	753	284	8.6
Over 50 "	16	3 050	948	659	288	9.4
<i>Totals and averages</i>	75	3 284 fr	1 082 fr	777 fr	304 fr	9.3 %

These groups of farms are not yet sufficiently numerous for drawing general conclusions; besides the average data, so calculated, neutralise the influence of each factor of production which may characterise the management of each farm. That is the reason why the statistical elaboration of the data includes also an analysis of capital, gross yield and net yield, so that the influence of different kinds of capital and branches of production on the net return may be determined. Besides these accounts, the "Dansk Land" Society published, in 1918, the results of its statistical work on 39 accounts chosen from among the best sent in by 63 farmers at a competition for agricultural accounts. The results are reproduced in Table IV.

TABLE IV. -- *Results of accounts for the year 1916-1917 submitted at a competition promoted by the "Dansk Land" Society.*

Value classes of the farms	Number of farms	Average area	Total capital per ha.	Net yield per ha.	Yield per cent.
I - Total capital over 50 000 kronen (69 450 fr)	13	46 ha.	3208 fr	297 fr.	9.3 %
II - Total capital from 20 000 to 50 000 kronen (27 780-69 450 fr)	11	16	3061	308	10.1
III - Total capital under 20 000 kronen (27 780 fr)	7	6	3287	375	11.4

The percentage yield of the 31 farms averaged 9.5 %.

The percentage distribution of the net receipts of the farmer between the capital employed, the work done and the profit remaining after these means of production have been paid for, is indicated in Table V.

TABLE V. -- *Percentage distribution of net receipts of the farmer and how the net receipts are used.*

Value classes of the farms	Percentage distribution of net receipts of the farmer			Use made of the net receipts of the farmer		
	Interest on capital	Wages	Farmers' profit	For interest	For private use	For working capital
I	51 %	9 %	37 %	23 %	36 %	41 %
II	49	26	25	13	48	39
III	44	56	0	20	103	+ 23

for the 3 categories of farms classed according to the total capital represented. The same table also gives, for the same classes, the manner in

which the net receipts are used, in practice, by the different classes of farmers, on a basis of 900 kronen (1210 fr. at par) for wages of labour and 5 % as the rate of interest on capital.

For small farms the net receipts of the working farmer do not suffice for his private use, so that his excess requirements must come out of the working capital, thus decreasing by 4.7 % the net wealth of the farmer.

AGRICULTURAL INDUSTRIES.

980 - **The Cinchona-Wine Industry in Piedmont.** — PIANO, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Nos. 5-6., pp. 291-304. Modena, 1919.

INDUSTRIES
DEPENDING
ON PLANT
PRODUCTS

For some years past in Piedmont, side by side with the vermouth industry, there has sprung up the manufacture of cinchona wine.

The greatest number of factories is to be found in the provinces of Turin and Cuneo; in the former preference is given to the use of white wines of high alcohol content, and in the latter to red wines of the Barolo and Barbaresco types. In these two provinces cinchona wines are also made from grapes which have been left for a long time on the stem after maturity and are aromatic, like the "passito" (withered) of Caluso, the muscat of Canelli, etc.

Cinchona wines are prepared by adding spirit and sugar to the selected wine and giving a bitter taste to the mixture with cinchona bark. Some factories do the latter operation directly with the bark (by maceration) and others prepare beforehand the alcoholic extract of cinchona (by mixing).

In the first process finely powdered Calisaya cinchona bark is macerated 5 days in the wine, at a temperature of about 50° C., care being taken to stir the mixture frequently in order to help the extraction of the alkaloids and bitter principles in the bark, and to use closely covered vessels so as to prevent the loss of alcohol. At the end of the above period, the liquid is separated by decantation or filtering, and alcohol and sugar are added in the required proportions. In some cases, where an aromatic product is desired, cinnamon, vanilla and cloves are added along with the cinchona bark.

The mixing process consists in extracting the bark with alcohol in displacement apparatus, and in preparing the wine, to which sugar has previously been added, with the alcoholic extract of the bark.

Before being put on the market, the wine thus prepared is kept for some days at a temperature of — 6 to — 9° C. to clarify and remove acidity from it, after which period it is filtered and bottled.

Some makers prepare this wine by making the concentrated must bitter, while others, to get a white product, decolorise red wine by treatment with 50-100 gm. of animal charcoal per hectolitre.

Several years ago, cinchona wines were made exclusively for local use, and only in 1907 did foreign export in any quantity begin. The trade began with France, Switzerland and Germany and later extended to England, Argentina, Brasil, Uruguay and the United States; at present these wines are sent also to Greece, Egypt, the Italian colonies in Africa,

etc. Fairly large quantities have recently been sent to Albania. Cinchona wine is sent out in bottles of about $\frac{3}{4}$ litre or in casks; the former go mostly to Argentina, Brasil and the United States, the latter to France, Switzerland, Albania, Tripoli and Cyrenaica.

A series of analyses (86) made by the authors and set out in tables show that cinchona wines contain from 10.35 to 20.25 % of alcohol by volume and from 34.9 to 207 $\frac{\text{‰}}{100}$ of sugary matter. As a rule, however, they have 15 to 17 % of alcohol by volume and from 14 to 16 % of sugar compounds.

The extract, not including the sugar, varies between 14 and 60 per thousand, total acidity between 2.17 and 7.65 per thousand and volatile acids between 0.36 and 2.55 per thousand.

The ash varies between 1.24 and 3.36 per 1 000, the alkalinity of the ash from 4 to 25, and the glycerin from 3.37 to 8.29 per 1 000.

The alkaloid content lies between 0.34 and 0.97 per 1 000.

In short, except for the difference in the bitter used, it may be stated that cinchona wines show a marked similarity in chemical composition to vermouth.

981 - **Wine made from Dried Figs.** — GARINO-CANINA, I. (R. Stazione enologica sperimentale di Asti), in *Giornale vinicolo italiano*, Year XLV, No. 30, pp 260-261. Casale Monferrato, July 27 1919.

The author prepared in the laboratory a wine from dried figs, using fruit which had the following percentage composition: — Water 26.00; reducing sugars, 45.60; dextrose, 24.60; levulose, 21.00; pentosans, 3.80; total nitrogen, 0.398; protein ($N \times 6.25$), 2.50; ash 2.20, with an alka-

TABLE I. *Composition of dried-fig must.*

		Grammes per 1000	Cc of normal solution per 1000
Density at 15° C	1.0659		
Total extract		171.200	—
Reducing sugars		135.300	—
Dry extract without sugars		35.900	—
Ash		3.260	—
Including Phosphoric residue (PO_4)		0.517	—
Sulphuric " (SO_3)		0.720	—
Ni-trogen { total		0.860	—
of amino acids		0.180	—
ammoniacal		0.042	—
Acidity with litmus		—	17.06
Alkalinity of ash (FARNSTEINER method)		—	16.94
Acid { tartaric, total		traces	—
malic "		1.810	27.00
lactic "		0.015	1.70
succinic "		0.059	1.00
Total volatile acidity		0.120	2.00

TABLE II. - *Composition of dried fig wine.*

	Grammes per 1000	Cc. per 1000
Density of fig wine at 15°C.	0.9930	
Density of distillate in terms of primary volume - 0.9890, corresponding to alcohol	63.400	7.99
Density of residue of distillation 1.0086, corre- sponding to total extract	20.000	—
Reducing sugars	1.600	—
Dry extract without sugars.	18.400	—
Glycerin	0.100	—
Pentosans.	0.800	—
Ash	3.200	—
including: Phosphoric residue (PO_4)	0.340	of $N/1$ solution 11.4
Sulphuric (SO_4)	0.695	17.4
total	0.350	—
Nitro- gen	of protein	0.001
	of amino-acids.	0.040
	of amide	0.010
	ammoniacal	0.003
Acidity	total, expressed as malic acid	2.550
	volatile, " " acetic "	0.340
	fixed, " " malic "	2.210
Alkalinity of ash (FARNSTADLER method)	—	18.00
Index of alkalinity	—	5.60
acid, total determined	traces	—
Acid	malic " "	1.620
	lactic " "	1.770
	succinic " "	0.170
	acetic " "	0.380
GAUTHIER ratio — 0.85		
HALPHEN ratio	R 0.285	
	C 0.607	
To 1000 gr. alcohol correspond 9.6 g glycerin		

linity (official method), expressed in cc. of normal solution, equal to 18.80, and a phosphoric residue (PO_4), expressed in grammes equal to 0.176; total acidity by litmus test, 4.20; pectic substances, cellulose, gums, etc. (by difference), 18.00.

On extracting 1 part of finely cut-up dried figs with 3 parts of hot water and then filtering, a must is obtained which has the composition shown in Table I.

The must from dried figs makes an excellent culture medium for saccharomycetes, on account of its complete mineral composition and the presence of proteolytic ferments, which more or less thoroughly break up protein substances into simpler and more easily assimilated nitrogenous compounds.

With the help of strong alcohol-producing ferments, alcoholic fermentation was induced (at 28° C.), which was very brisk, until the sugars were almost completely decomposed.

Once fermentation was finished, the resulting liquid very quickly became clear, of golden yellow colour (the pigment behaving differently from that of grapes) and had a not disagreeable taste, resembling beey more than figs. After lying a long time on the lees it acquired a bitter taste. Besides, in the case of natural fermentation, pathological ferments such as mannitic and acescency may be produced, being favoured by the low acidity of the medium.

This alcoholic liquor has the chemical composition shown in Table II.

Examination of the analytical results, especially of the ratios between the constituents of the alcoholic liquid (at the concentration indicated in Table II) shows essential differences from the corresponding values of grape wine; thus:—

1) The total acidity is slight and almost entirely lacking in tartaric acid, so that the ratio between the one and the other is nearly 0 % (against 30-40 % in grape wines). The low value of the succinic acid with respect to the alcohol is also to be noted.

2) The proportions of nitrogenous substances (especially amino-acids) are high.

3) The same may be said of the proportions of pentosans and of ash, in which the phosphoric and sulphuric residues attain very high values.

Hence these differences simplify the chemist's task in cases where dried figs are to be recognised in wines as a substitute for grapes or even entirely in place of these.

982 - **A New Mannose Ferment: Research in Italy.** — MEZZADROLI, G., in *Le Stanioni sperimentali agrarie italiane*, Vol. LI, Nos. 7-8, pp. 306-311. Modena, 1918.

When the saccharification of residues from the manufacture of articles in vegetable ivory or corozo is brought about by the use of dilute mineral acids, a reducing substance consisting of mannose is obtained. These saccharification liquids involve some difficulty in the complete fermentation of the mannose to industrial strength. Literature on the subject mentions several ferments capable of bringing about this fermentation: *Saccharomyces apiculatus*, *S. cerevisiae*, Saké yeasts, some German yeasts, etc. The author has been able to try only the yeasts in his zymological collection, viz. *S. apiculatus*, a Dortmund yeast, some industrial yeasts from Brussels, Berlin, Kieff and one he isolated from Apulian products. The yeasts showing some fermentative power were *S. apiculatus*, the Dortmund and the Saké, while the Apulian one turned out to be a true mannose ferment. Put in musts of d-mannose only, at different concentrations (from 3 to 12 %), it caused a regular and rapid alcoholic fermentation and gave a yield in alcohol (by volume) of from 57 to 58.3 %.

This yeast may be regarded as a simple ferment; some traces of phosphate of ammonia are sufficient to enable it to cause complete fermentation. It brings about a good fermentation of dextrose, mannose, sorbose, saccharose and maltose, and weak fermentation of lactose, raffinose and inulin.

Beet juice and molasses, wort of wheat and cane molasses, locust

beans, figs, etc., ferment with the same ease when aided by mannose ferments; the duration of the fermentation does not exceed 32 to 48 hours; all the sugar is transformed into alcohol or at least there remain only some traces of unfermentable sugars. The yield of alcohol, as a % of the sugar, was: 57.1 for wheat wort — 60.3 for beet juice — 61.2 for beet molasses wort — 58.75 for cane molasses wort.

The size of the cell bodies of this yeast vary from 3 to 5 μ in length and 2.5 to 4 μ in breadth; the optimum temperature is about 30° to 30° C.; at 40° C. the yeast still acts well; at 45° C. the fermentation of sugar is no longer complete and at 50° C. it is almost nil.

This yeast, on account of its polyvalent enzymatic action on many sugars, will be available for use in distilling, especially for the fermentation of cane molasses.

983 - **The Fruits of *Melia Azedarach*; Their Possible Use for the Manufacture of Alcohol.** — RIGOTARD, L., in *L'Agronomie Coloniale, Bulletin mensuel du Jardin Colonial*. New Series, Year III, No. 24, pp. 186-188. Paris, May-June, 1919.

During a sojourn at Marrakech (Morocco), the attention of the author (Assistant at the Jardin Colonial, France) was directed to the *Melia Azedarach* L. (Indian lilac, Chinese lilac), a shrub of fairly wide distribution in this part of Morocco, as in the whole Mediterranean basin, where it is not utilised except to ornament gardens, for which purpose it is sought after on account of its fine lilac flowers (1).

As the yield of fruits is high, the author thought a laboratory examination might suggest a use for the crop, and he analysed the fruits at the laboratory of the Jardin Colonial. The following are the results of his research: —

At maturity the fruit, of the size of a cherry, is nearly spherical, with fleshy pericarp, soft, whitish in colour, translucent; the odour is nauseating; when dried the fruit is wrinkled, and of a yellowish brown tint. The stone, which has 5 or 6 large meridional ribs, pierced at its polar axis, contains several kernels (5 or 6 meridional swellings, 3 or 4 kernels developed only, although the fruit is originally 5-celled).

100 fruits air-dried (9.44 % water in the pulp) weigh	81.1 gm.
100 stones weigh	30.0 gm.
100 kernels weigh	5.0 gm.
Proportion of stone in air-dried fruit,	37 %
Containing proportion of pulp,	63 %
Proportion of kernel in stone, about	50 %
Or, in the whole fruit	18.5 %

The kernel is of a dark brown purple tint, and oily. The outside pulp of the fruit, which has an accentuated sugary taste, on analysis gave: water 9.44 % — ash 4.18 % — nitrogenous matter (19 x 6.25) 12.15 % — directly reducing matter expressed as

(1) The fruits are known to be used for making garlands, whence the names "garland tree", "holv tree". Different parts of the plant have vermifuge, and vomitive properties, which are made use of in some countries. (Ed.)

glucose 27 % — reducing matter after inversion, expressed as saccharose 2.88 %, or, in all, sugary matter 29.88 %. In relation to the whole fruit proportions are : directly reducing sugars 16.91 % — reducing sugars after inversion 1.81 % — total sugars 18.72 %

On account of their sugar content, it may be hoped to use the fruits of *M. Azedarach* in the preparation not of a fermented drink, as it appears they are fairly poisonous, but of alcohol by fermentation and distillation. If this fermentation is possible, it will yield, in alcohol at 100° G. L., nearly 10 % or the air-dried fruit.

984 — **The Sugar Industry in Japan.** — *Bulletin de l'Office Colonial*, Year XII, No. 135, pp. 196-197. Paris-Melun, March, 1919.

After getting possession of Formosa, where some sugar cane had always been grown, the Japanese sent agents to the United States to study the sugar industry, and encouraged its development in the island. The first refinery was set up in Japan in 1896 ; at present there are 8, capable of turning out 1 300 tons per day. The chief market is China, where Japanese sugar is gradually supplanting that of Hongkong.

The principal development centre is Formosa (Jofwan), in which government assistance is most in evidence: the employment of experts, the setting up of scientific establishments and the loaning of machinery ; and the production there rose from 60 000 tons in 1902 to 75 000 in 1906 and 406 000 in 1916. The first sugar factory was built in Formosa in 1900 ; at the present day there are 37 factories with a capacity of 27 240 tons of cane per day.

985 — **Method of Identifying Dried Sugar Beet and Mangels.** — STANEK, V., in *Zeitschrift für Zuckerindustrie in Böhmen*, Year XLII, No. 6, pp. 291-293, 2 tab. Prague, March, 1919.

It is known that the dry matter of sugar beet contains less ash and much less alkali and nitrogen than the dry matter of fodder beet. The author has sought to establish, by determining the ash content, a means of distinguishing dried sugar beet and mangels.

The material is dried and pounded in a porcelain mortar ; 7 to 10 gm. of the powder thus obtained is weighed out, desiccated and burnt ; the ash is weighed, dilute cold hydrochloric acid added, filtered, and then the insoluble residue is dried and calcined. In this way the weight of total ash is determined, and that of ash insoluble in hydrochloric acid and also that of ash soluble in the acid.

On analysing some samples of known origin, the author obtained the following data for the above three quantities (as percentages) :— sugar beet : 3.59 — 1.24 — 2.35 ; yellow mangel : 5.94 — 0.84 — 5.10 ; id : 6.50 — 0.28 — 6.22 ; white half-sugar beet : 4.67 — 1.34 — 3.33 ; red mangel : 7.60 — 0.87 — 6.82 ; white half-sugar beet : 5.50 — 0.19 — 5.31 ; sugar beet : 2.40 — 0.12 — 2.28.

It will be seen that the dry matter of sugar beet contains from 2.28 to 2.35 % of ash soluble in dilute hydrochloric acid ; that of half-sugar beet from 3.33 to 5.31 %, and that of mangel from 5.10 to 6.82 %.

Hence, it is possible, on the basis of these data, to distinguish mangel

beet from sugar beet when homogenous material is being dealt with. A content of soluble ash varying around 3 % would indicate a mixture of mangel and sugar beets.

986 - **Flour Mills in China.** — CHANG, Y. I., in *Bulletin économique de l'Indochine*, Year XXII, No. 131, p. 113. Hanoi-Haiphong, January-February, 1919.

Wheaten flour is used plentifully in the North of China. It was obtained first by primitive methods, and it is only since the last 20 years that the first flour mills made their appearance, first at Shanghai, then in other towns in China. The flour manufactured by Chinese methods is still used in large quantities, but that produced in the flour mills shows increased popularity as a result of its better quality. It is estimated that 50 to 60 million dollars worth of flour is produced in the flour mills of Shanghai alone per annum.

Although the silk and cotton spinning mills (1) are mostly owned and managed by Europeans, the flour mills are almost exclusively Chinese; now, a certain amount of competition with Japanese flourmills is beginning to be felt.

There are at present more than 36 flourmills, large and small, in China, at Shanghai, Nanking, Wuhu, Hankow, Chinang, Tientsin, Pekin, Wusieh, Tsichow, Kaoyuei, Chinkiang and Tsinkiang; it is reckoned there are 17 at Shanghai, 3 at Hankow, 5 at Wusieh, and one or two in the other localities. The 17 flourmills at Shanghai could supply 70 sacks of flour per day, but the majority do not work at night, and when the demand is scarce, they even cease work, only starting up again when market conditions are once again favourable.

The flourmills can obtain in China all the wheat that they require. According to moderate estimates, China produces annually 26 000 000 metric quintals of wheat, grown chiefly in the north, particularly in Manchuria.

Compared with the total produce from the flourmills, the sum total of the flour exports is insignificant. In 1914, the exports were only 339 839 taels, and those of 1910, which rose to 9 016 589 taels seem to have been an exception. As a general rule, China is still obliged to import flour in a considerable quantity, and with her immense population, she ought to be able to provide work for many more flourmills than are now in existence.

Most of the flour exported from China was sent to Japan for Japanese consumption or re-exportation to other countries. As a result of the lack of shipping facilities, Chinese merchants have not been able to export direct, and the trade has, therefore, passed into the hands of the Japanese.

The latter have not only seized the export trade to other countries, but also to other districts of China, such as Foochow, Svatow, Canton, etc., which are connected with Shanghai by Japanese lines. It is significant that they trade with their clients at a month from sight, whilst the Chinese merchants, through lack of money, require immediate payment.

(1) See No 885 of this Review. (Ed.)

In order to stimulate the progress of the milling industry an exchange has lately been opened up and an extension of this is under consideration.

987 - **Hydration Capacity of Gluten from "Strong" and "Weak" Flours.** — GORTNER, R. A. (Division of Agricultural Biochemistry, Minnesota Agricultural Experimental Station) and DOHERTY, F. H. (Oregon Agricultural College), in *Journal of Agricultural Research*, Vol. XIII, pp. 389-416, No. 8, 17 diagr., bibliogr. of 19 works. Washington, May 20, 1918.

It is well known that there are many variations in the baking quality (or adaptability for breadmaking) of flour prepared from different wheats.

The hard spring wheats, especially those of the northern portion of the Great Plains area of North America, produce a flour of superior baking qualities. To differentiate between these qualities of flour, the terms "strong" and "weak" are used.

According to the definition adopted by the National Association of British and Irish Millers, a wheat is termed strong when the flour is capable of making large well piled loaves. In a similar way, W. JAGO and W. C. JAGO (*The Technology of Breadmaking*, London, 1911) define strength of flour as "the measure of the capacity of the flour for producing a puffed up dough and a bold, large volumed, well risen loaf".

The authors make a rapid survey of previous work dealing to this question, then describe their investigations with a view to determining the possibility of a correlation between the baking quality of the flour and the hydration capacity of gluten, and if it does exist, in determining its correct constitution.

They present, in the form of tables and diagrams, the data showing the increase or decrease of water imbibition obtained by the immersion of weighed discs of gluten, manufactured from carefully selected flours in solutions of lactic, acetic, boric, phosphoric, hydrochloric, oxalic acids of various concentrations, with or without the addition of 0.005 molecular concentration of certain salts. In addition to this, they give analyses of flours, with determinations of the soluble ash, of specific conductivity of flour extract, percentage of moist gluten, percentage of dry gluten, percentage of ash in dry gluten, and lastly, the results from baking tests.

From the complete data, the authors draw the following conclusions: --

Although the moist glutes from these flours differ widely in their baking quality and physical properties, they are hydrated to almost exactly the same degree. The gluten from a weak flour has, in comparison to that of a "strong" flour, much lower maximum hydration capacity, because it shows a much meaner degree of hydration when it changes from a "gel" to a "sol".

There are two types of imbibition curves. Dilute solutions of hydrochloric acid and oxalic acid cause the gluten to rapidly imbibe water, while, at slightly stronger concentrations of acid, water is actually extracted from the moist gluten. Dilute solutions of lactic, acetic, phosphoric acids make the gluten imbibe water strongly, but stronger acid solutions only diminish the imbibition slightly. The hydrogen-ion concentration

of the acid is not the only factor which influences imbibition, but the anion and the undissociated molecules, as well as their relative absorption by the protein, must, in all probability, be taken into consideration.

The addition of inorganic salts to an acid solution lowers the relative imbibition of gluten placed in these solutions. Glutens from the different flours react differently to the addition of inorganic salts.

The acid and salt contents are not responsible for the difference between "strong" and "weak" glutens.

The supposition that the differences in physical conditions observed in glutens derived from some flours are due solely to the presence or absence of a double electrical layer round the colloidal particles, is not consistent with the facts recorded in this paper. A "strong" gluten apparently differs from a "weak" gluten even at the isoelectric point.

There is an intrinsic difference between the glutens derived from the weak and strong flours. The physico-chemical properties of the glutens from the various flours are not identical, and they would not be identical even if the flours had originally the same acid and salt contents.

The difference between a strong and weak gluten is apparently similar to that which exists between a nearly perfect colloidal gel with very pronounced physico-chemical properties (such as pertain to emulsoids) and a colloidal gel, in which these properties are much less marked. The authors suggest that these differences may be due to the size of the gluten particles, and that at least some of the particles comprising the weak gluten may be nearer the boundary between the colloid and crystalloid states of matter, than is the case with the strong glutens.

988 - **The Use of Lime Water in Breadmaking.** — See No. 811 of this *Review*.

989 - **Chemical Analysis of Wheat Flour Substitutes and of Bread Made with these Substitutes.** — L. E. CLERC, J. A. and WESSLING, H. L., in *U. S. Dept. Agr. Bulletin*, No. 701, pp. 12, 7 pl. Washington, Sept. 20, 1918.

All the loaves analysed by the authors were made with mixtures composed of 75 % white wheat flour, and 25 % substitutes. The substitutes were as follows : —

(1) Poor in proteins and rich in carbohydrates (starch from banana, tapioca, colocasia, chestnuts, potatoes, and sweet potatoes).

(2) Grains and cereals (rice, maize, rye, oats, barley, buckwheat, sorghum, millet).

(3) Flour from leguminous seeds (beans, peas, chick peas, soya, groundnut).

(4) By-products (bran, wheat germ, decorticated cotton cake, soya cake).

A series of tables shows a detailed analysis of the wheat flour, of each of the substitutes, and the bread made with the wheat flour alone, or with that plus 25 % of each of the substitutes. The analytical data concern-

ing the different loaves are calculated either on the dry matter or on a substance containing 35 % moisture, which makes them comparable.

All the bread containing the wheat flour substitutes, (except when a starch or rice flour is used) were, compared to the bread from wheat alone, richer in mineral substances (they varied between 1.28 and 2.19 %); the differences between the various loaves with regard to fat content (which varied from 1.12 to 9.45 %) were only obvious when the flours from soya or groundnut were used; the number of calories per kg. does not vary much for the different breads (from 2630 to 3080); the protein content varies from 7 %, when starch is used as a substitute, to 14.9 %, when the soya cake is used, and to 15.87 % when the decorticated cotton cake is employed. All the percentages relate to the bread with 35 % moisture.

The colour of the bread made with these substitutes was more or less similar to that of the substitute employed.

990 - **The Oilseed Industry in Italy.** — GERVASO, O., in *Comitato nazionale per le tariffe doganali e per i trattati di commercio, Ufficio tecnico per l'agricoltura e le industrie agrarie*, Part 1, pp. 11-2, Rome, 1919

In addition to olive oil, Italy produces notable quantities of edible oils from oleaginous seeds (220 000 to 230 000 quintals per annum), but these seeds are largely imported from abroad.

Amongst the home-grown seeds which are used for the production of edible oils, it is important to note in the first place those from colza and rape, the cultivation of which has a certain importance in the northern plains of Italy, not exceeding 30 000 to 40 000 ha. and serving chiefly as fodder; the oil produced probably does not exceed 20 000-30 000 quintals, and it is principally required for the cheese trade.

With the exception of linseed, the oil of which is used as food only in a few parts of North Italy, the groundnut is also cultivated in Italy and has spread to a certain extent in the provinces of Naples and Salerno. The extension of this crop is impeded by the fact that it necessitates irrigation or at least frequent rainfall, as it now stands, the production is limited to a few thousands of quintals. Lastly, oil is also extracted from maize seeds, from nuts and from grape pips. Under the prevailing conditions of Italian agriculture, the cultivation of sesame, of sunflower, poppy, and soya are of little importance. It can be estimated that the total quantity of edible oils extracted from oil-seeds grown in Italy does not exceed 50 000-60 000 quintals.

The quantity of edible oils made in Italy from oil seed imported from foreign countries is much more important. According to information furnished by the manufacturers, there are in Italy 6 factories of some importance which use in all 400 000 quintals of oil seeds (chiefly groundnut and colza); 4 other small factories which use 20 000 qtls. of seed groundnut and sesame), and lastly the small maize oil factories (germs of maize grain) which should preferably be termed oilcake factories, their final object being to manufacture oil cakes from maize destined for cattle feeding. The average oil produced from oil seeds is calculated at 40 % of the weight, so that

the total product is estimated at 160 000-170 000 qtls. of which 120 000-130 000 is intended for human consumption.

Including the above mentioned oils (nuts, grape pips, etc., and a certain quantity of linseed oil destined for edible use), it can be presumed that the quantity of edible oils manufactured in Italy, either with home grown or imported seed, amounts to about 180 000 quintals.

The oil cakes must be considered as a very important by-product of the oil-seed industry (1).

Trade in oil seed cakes

Varities	Italian output	Imports	Exports	Amount destined for consumption
	quintals	quintals	quintals	quintals
Groundnut	5 000	—	—	5 000
Copra	35 000	30 000	—	65 000
Colza	90 000	—	—	90 000
Linseed	250 000	—	—	250 000
Castor oil	100 000	—	—	100 000
Sesame	140 000	20 000	100 100	60 000
Malze	90 000	—	—	90 000
Sundry	20 000	20 000	—	40 000
<i>Totals</i>	730 000	70 000	100 000	700 000

Such are, according to the information furnished by the manufacturers, the average amounts of oil-seed cakes produced and consumed in Italy for the feeding of cattle and as manures. With the exception of the oilcakes obtained from castor oil, the oil of which is not edible, and of linseed cake the oil of which is destined only in small quantity for alimentation, and of that of copra, the oil of which is only intended partly for the production of butter substitutes and oil, the industry of edible oils from oleaginous seeds produces about 300 000 quintals of oil cakes.

The figures above-mentioned demonstrate that the oil industry has become very important in Italy, which is an important olive-oil producing country. That signifies that the industry has such elements of vitality and success, that it can exist side by side with the agricultural olive oil industry properly so-called.

(1) See INTERNATIONAL INSTITUTE OF AGRICULTURE *The International Movement of Concentrated Cattle Foods* No. 1 and following issues (Ed.)

991 - **Fat and Oil Industry in Russia.** — *Institut Colonial de Marseille, Bulletin des Matières grasses*, No. 1, pp. 32-35. Paris 1819.

From the Russian Chamber of Commerce at Paris, the following information with regard to animal and vegetable fats and oils has been received.

Butter. — The annual production of butter increased to 9 million poods (1 pood — 36.07 lb.) in 1913, according to the reports based on the transport data for this merchandise on all the railroads in Russia. In addition to this amount, and during the same year, 4 770 000 poods were exported to other countries, and the home consumption was 4 230 000 poods; the production of butter during 1917 was registered at 4 500 000 poods, owing to the considerable diminution in the butter output in Siberia, the principal seat of this industry, where from 6 000 000 poods, the usual rate of production, it fell to 3 500 000 poods during 1917. In the same way, butter production in European Russia is also on the decrease: from 3 million poods, it has fallen to 1 million

Fats from pig, ox, cow and sheep. — It appears that there are no statistics of the production of fats in Russia. The fats from the sheep, cow, and ox are used locally, as much in the small refineries as in the soap works which employ fats as raw material, with the result that these fats have escaped the transport statistics. In any case it can be approximately estimated for the year 1917 at 7 500 000 poods, basing the estimate on the fact that the legislative areas in European Russia alone ought to have supplied 6 million poods of fats during the year mentioned.

On the other hand, Siberia and Turkestan should supply about 2 500 000 poods, consequently, the total sum of the production of ox, cow and sheep fats should give 7 500 000 poods, the higher figure noticed. The production of these materials in 1913 was 7 500 000 poods, and as there is no reason to count on any reduction the same figure can be definitely taken for 1917.

Sunflower oil. — Sunflower seed cake has been hitherto exported, and from the statistics on hand, the amount of this oil produced in Russia can be estimated, since, 100 poods of sunflower gives on an average 42 poods of oilcake, 23 poods of oil, and 35 poods of husk.

During the year 1913, 20 million poods of sunflower cake was exported, consequently the total quantity of seed which has served for oil fabrication has been about 45 million poods, and this has produced about 11 millions poods of oil. This figure has been confirmed by the rail transport statistics. In fact, according to these statistics, during 1913, 10 million poods were exported from the supplies of Kouban and of the Don, as well as the legislative areas of Saratof, Voronège, and Tambof (the principal centre for the cultivation of sunflower and the production of this oil); if to this is added that transported by water from the legislative area of Saratof, which has escaped the rail transport statistics, and that used for home consumption (11 million poods), the figure quoted alone is easily reached.

On the other hand, this figure for the annual production of sunflower oil is likewise confirmed by the data concerning the general crops of sunflower in Russia. On 1912 the harvest rose to 44 ½ million poods; in 1913 to 42 million poods, in 1914 to 50 million poods; as to the production of

sunflower oil in 1917, it ought hardly to have exceeded 9 million poods, as a result of the probably bad harvest in the legislative area of Saratof, of Tambof, and in part of the legislative area of Voronège. There is equally a reason to discount a certain amount owing to the difficulties of manufacturing under the present circumstances.

Linseed oil.— In order to estimate the production of linseed oil, the statistics of the export of linseed cake to foreign countries should be made use of, as they undergo the same fate as the sunflower oilcakes (they are almost entirely exported), while 100 poods of linseed give 70 poods of cakes, and 28 poods of oil. During 1913, 11 800 000 poods of linseed cake was exported.

Consequently the total weight of linseed produced in Russia rose to a level of 17 million poods, which has given 4 700 000 poods of linseed oil.

The estimated output of linseed oil in 1917, in spite of the prohibition of exportation of linseed, should have reached 3 million poods.

This reduction ought to be attributed to the fact that part of the district in which the linseed has been cultivated was invaded by the enemy and also to the fact that there was a certain decrease in the linseed sown in the interior of Russia.

Hemp oil.— If the exports of oilcake can prove useful in calculating the figures for the production of linseed oil and sunflower oil in Russia, it is not possible to ascertain the amount of hemp oil, seeing that a large part of the hemp oil cakes is consumed locally, and consequently does not appear in the statistic reports. During 1913, 3 500 000 poods of hemp cake were exported. Now, 100 poods of hempseed produce on an average 75 poods of oilcake and 22 poods of oil. The minimum quantity of hemp oil, based on the oil cake export figures, ought then to be 11 million poods; but in reality, the oil produced is very much more. According to agricultural statistics, the total area of land used for hemp plantations was 543 000 deciatines (1), and as a result the total harvest has been 16 million poods. If the 3 million poods necessary for seed, and 1 million poods exported to other lands are deducted, there remains for the manufacture of oil, 12 million poods of hemp seed, and this should produce 2 500 000 poods of oil.

Cotton oil.— The amount of cotton oil manufactured in Russia can be calculated from the crop of ginned cotton, which, for the last few years is shown as follows:

1912	13 million poods
1913	14 million poods
1914	17 million poods
1915	27 million poods

(1) 1 deciatine = 1.09 hectares = 2.70 acres. (Ed.)

Assuming that 2 poods of cotton seed give 1 pood of ginned cotton, the total quantity of cotton seed can be estimated thus : —

26	million	poods	in	1912
28	"	"	"	1913
34	"	"	"	1914
54	"	"	"	1915

The proportion of oil produced from the seed is on an average, 50 %, and taking this figure as a basis, it can be concluded that theoretically the quantity of cotton oil produced in Russia for the season 1916-17 would have been 7 million poods. For the year 1913 in which the harvest amounted to 28 million poods, the manufacture of oil reached 4 200 000 poods. But, certainly, as facts show that there were some seeds of bad quality, and that part of the crop was used as cattle food, the true amount of production of cotton oil should have been 5 500 000 poods for the fiscal year 1915-16 and 3 million poods for the fiscal year 1913.

The production of cotton oil during 1917 will not have exceeded 3 million poods, because of the decrease in the area sown which was about 50 % as compared with 1916.

Soya, olive, coconut, and palm oils. — All these oils were, before the war, entirely imported from abroad; in the year 1913, the importation of these oils amounted to 700 000 poods. Coconut oil is, however, manufactured in Russia with imported copra; during 1913 the importation of copra rose to 4 million poods; which produced 2 500 00 poods of coconut oil. At the present time owing to the war, import into Russia of all these oils, including copra, has completely stopped.

Other oils — *Mustard, rape, colza, etc.* — During 1913, 9 500 000 poods of oilcake from all the oleaginous seeds were exported; from this amount, 1 500 000 poods of copra oilcake must be deducted, as well as 1 million poods of cotton cakes; which leaves for mustard, colza, rape, and other oilcake a total of 7 million poods. As the employment and consumption of these oilcakes in the home country is very small, the quantity of exported oilcakes can be taken as equal to the true amount of production of the oils from these species. Now, 100 poods of mustard, rape, and colza seed give about 70 poods of oilcakes, and 20 poods of oil. Combining these facts with the exportation of 7 million poods of oilcake from these species, the production of these oils can be estimated at 2 million poods.

The production in the year 1917 ought to be similar to that in 1913, that is to say, 2 million poods.

General situation. — If a general survey is made of the production of all the vegetable oils, for the year 1913, a total weight of 25 700 000 poods will be arrived at.

A comparative table of the annual production, imports and exports of fats (Finland excepted) is given below (p. 1003).

According to the statistical reports, the number of oil works in Russia in 1913 was 455; out of this number, 307 large factories produce 18 500 000 poods of oil per annum; 148 other less large factories

*Production, importation and exportation of fats and oils in Russia
in 1913 and 1917 (in thousand of poods).*

	1913				1917			
	Pro- duction	Impor- tation	Expor- tation	Balance for consum- ption	Pro- duction	Impor- tation	Expor- tation	Balance for consum- ption
Butter	9 000	90	4 700	4 330	4 500	—	—	4 500
Fats from pigs, cattle and sheep	7 000	2 510	30	9 980	7 500	—	—	7 500
<i>Total of animal fats .</i>	16 500	2 600	4 700	14 310	12 000	—	—	12 000
<i>Oils :</i>								
Sunflower	11 000	—	240	10 760	9 000	—	—	9 000
Linseed	4 700	—	26	4 674	3 000	—	—	3 000
Hemp	2 500	—	6	2 494	2 500	—	—	2 500
Cotton	3 000	—	—	3 000	3 000	—	—	3 000
Soya	—	235	—	235	—	—	—	—
Olive	—	302	—	302	—	—	—	—
Coconut	2 500	—	—	—	—	—	—	—
Palm	—	205	—	2 705	—	—	—	—
Other oils	2 000	—	193	1 807	1 000	—	—	1 000
<i>Total of oils .</i>	35 700	742	465	25 977	18 500	—	—	18 500
<i>General totals .</i>	42 000	3 342	5 255	40 287	30 500	—	—	30 500

have not furnished exact details concerning their production. However, if the approximate amount from these latter factories is established, and if it is noted that the production from 307 oil works is doubtless diminished, it can be concluded that the general amount of vegetable oil in Russia fixed at 25 million poods is exact and corresponds to the identical production. Taking the principal centres, the despatch of vegetable oils by rail during the years 1912-1913-1914 was, for 25 legislative areas and provinces, 14 080 000, 16 319 000 and 14 432 000 poods respectively. These figures do not include the transport of cotton oil, the production of which can be estimated at 3 million poods.

992 — **Fats and Oils in Bulgaria.** — E. B. in the *Revue de Chimie Industrielle*, Year XXVIII, No. 327, pp. 94. Paris, March 1919.

The annual consumption by Old Bulgaria of edible oils reaches 3400 tons, of which 2400 is imported; in addition to this the industry uses 800 tons of fats and oils, 600 of which comes from foreign lands.

The indigenous production of oil-seeds is greater than the consumption, but, because of the defective and rudimentary treatment of the oil in the country, it is usual to export the seeds, so that oil produced by the native

industry is insufficient for the home consumption; the plant and methods of work should be improved.

The only soap factory which has worked without interruption since the war is that at Kostinbrod, where bone fats are extracted. The supply for the army in 1917-18 amounted to 288 842 kg. of glycerin, 1500 kg. of lubricant oils for automobiles and 19 000 kg. of leather fats. In 1916-17, the soap production was 384 866 kg.

993 - **Rubber Seed Oil.** — DUBOSC, A., in *Le Caoutchouc et la Gutta-Percha*, Year XVI, No 183, pp 9785-9786. Paris, May 15, 1919.

One litre of rubber seed weighs 364 gm. and contains 52 % oil and 6 % water. The oil is a pale yellow liquid, with a smell similar to that of linseed oil, and the following are its physical constants: Refractive index, 1.472, saponification number, 1919, iodine number, 1308; REICHERT-MEISSL number, 0.30; HEHNER number, 95.37.

This oil can be utilised in a soap-making, in the preparation of oil paints, varnish, and burnt oils; it can also be employed in the manufactures of oiled papers and fabrics for use as substitutes for window glass.

The author has tried it for the preparation of artificial materials, and has stated that it behaves in the same way as linseed oil, and gives good black imitations.

994 - **Grape Oil from the Canadian Vine (*Vitis hederacea*).** — *Bollettino dell'Associazione Italiana Pro piante medicinali, aromatiche ed altre utili*, Year II, No 4, pp. 56-59. Milan, April, 1919.

The Canadian Vine (*Parthenocissus quinquefolia* Planch. = *Vitis hederacea* Ehrh.) a native of North America, is very well known throughout Europe as an ornamental plant. Professors S. FACHINI, and G. DORTA have made a study of the fruits from the point of view of their oil content with the following results: —

Composition of the fruit: Grape stalks 15.6 %; grapes 84.4 %.

Chemical compositions of the pulp and skins (of freshly gathered fruits): — Water 3.30 %; crude protein 20.11 %; fibre 11.26 %; ash 0.18 %; nitrogen-free extract 24.15 %.

Chemical composition of fresh air-dried seed: Water 13.05, crude oil 11.80; fibre 18.00; ash 5.22; phosphoric anhydride in the ash 2.33; protein 12.68; nitrogen-free extract 39.27 %.

OIL EXTRACTED FROM THE PIPS. — The oil obtained from the pips carefully separated from the pulp by pressure and extraction by means of solvents, is liquified at a normal temperature and has a green or dark yellow colour with a smell similar to nuts, and a sweet and agreeable taste.

They possess the following characteristics:

Sp. gr. at 15° C = 0.9215; refractive index n_D^{25} = 1.4778; saponification number 189.2-189.6; iodine number 131.4-141.6; fixed fatty acids 93.97 %; volatile fatty acids nil; non saponifiable 1.44 %

Characteristics of the fatty acids: Iodine number 144.6; mean molecular weight 281.2; iodine number of liquid fatty acids 148.8-149.9.

The solid fatty acids in the oil from the pips does not exceed 3 %; they melt at a temperature of 57.6° C. and their average molecular

weight = 261.4; they are composed of palmitic acid; no stearic acid has found. The *liquid fatty acids* are composed of oleic and linoleic acids.

OIL EXTRACTED FROM THE PULP AND SKIN. — The oil from the pulp and skin obtained by pressure or by means of solvents is olive green with an agreeable odour, and has an astringent taste. At a normal temperature it forms a mass of buttery consistency with a crystalline appearance; it bleaches quickly and turns rancid in the air and light. Its characteristics are: —

Refractive index, 1.4722; saponification number, 192.3-193.3; iodine number, 90.3; fixed fatty acids, 94 %; volatile fatty acids, nil; Non saponifiable *ditto* 1.67 %.

Characteristics of fatty acids: Iodine number, 91.4-91.6; mean molecular weight, 278.8; iodine number of the liquid fatty acids, 110.2.

The solid fatty acid content of pulp and skin oil is about 10 % and consists of palmitic acid. The liquid fatty acids are oleic and linoleic.

CONCLUSIONS. — These researches show that the grape in Canada contains 2 kinds of oil; in the pip, a oil liquid at the normal temperature, belonging to the group of semi-drying oils, containing a large amount of linoleic acid; and in the pulp and skin, an oil of a buttery consistency, that is to say, containing a greater quantity of solid fatty acid and, amongst the liquid fatty acids, a preponderance of oleic acid, but only a small amount of linoleic acid; this fact does not occur often in the composition of other fruit on a single plant.

995 — Oil of Fenugreek. — WUNSCHENDORFF, H. E. (Chef de travaux à la Faculté de Médecine d'Alger), in the *Journal de Pharmacie et de Chimie*, Year III, S. 7, Vol. XIX, No. 11, pp. 393-398. Paris, June 1, 1919

The seeds of fenugreek contain about 7 % of a bright golden yellow oil with a disagreeable taste and smell, characteristic of drying oils. It does not give the elaidin reaction. Spread thinly on a glass plate, it solidifies rapidly and gives a fine golden yellow varnish, insoluble in ether.

This oil dissolves in ether, benzene, sulphide of carbon, and petroleum ether; in cold, absolute alcohol, only at 1 in 20, but if heated, a larger proportion dissolves; acetone only partly dissolves it.

The following is a list of the general characteristics:

Density at 15° C	0.9471	Acidity	3.20 %
Refractive index	1.4774	Solid fatty acids	92.90 %
Deflection in oleo-refractometer	43°	Volatile fatty acids . .	1.50 %
Saponification index	189.5	Unsaponifiable matter . .	0.90 %
Iodine number	137.8	Phosphoric anhydride . .	0.55 %
MAUMENÉ Index	98.9°		

The oil has a 6.25 % lecithin content and a 0.50 % phytosterin content.

The chief fatty acids are linoleic and palmitic; the linoleic and oleic acids exist in much small proportions.

Phytosterin melts at 132.5° C., and its acetate at 131° C.

996 - **The Oil of *Ceratotheca sesamoides*.** — RICHARDS, BOLTON E., in *The Analyst*, Vol. XLIV, No. 120, pp. 233-234. London, July, 1919.

The seeds of *Ceratotheca sesamoides*, which very closely resemble those of *Sesamum indicum*, are reddish brown in colour, and a little larger than the latter.

The author after examination of a specimen which came from the Gold Coast, and which was known there under the name of "Bunqu" managed to extract from the seeds by the aid of petroleum ether, 35.47 % of pale yellow oil. The following analytical figures were obtained: — saponification value 190.20; unsaponifiable matter 1.53 %; iodine value 110.60; refractive index at 40° C (Zeiss) 59.60; free fatty acids 0.63 %; specific gravity 0.9163.

This oil is edible and with its low fatty acid content it is specially adaptable for use in the manufacture of edible oils. If the seed could be collected in sufficiently large quantities, the oil would doubtless be of commercial value for use in the manufacture of margarine, etc.

997 - **Experiments on the Use of Wood Oil and Candelnut Oil in Soap-Making.** — HEIM, F. and DELHOTEL, E., in *Bulletin de l'Office colonial*, Year XII, No. 135, pp. 171-177. Paris-Melun, March, 1919.

I. WOOD OIL. - Wood oil (*Aleurites cordata* Müll. Arg.) the "Cây trầu" "Cây dân són" of the Tonkinese, cultivated or wild in Annam and Tonkin supplies from its seed kernel a dry oil which is in current use in China, and called in English trade Tungil, China Wood oil or simply Wood oil. It is a colourless or pale yellowish oil, without smell, viscous, and used in Indo-China as lacquer oil.

From the kernel a pale yellow oil is obtained by cold pressing and a dark brown oil by hot pressing.

These distinctly drying oils, do not solidify in the cold. Although the predominant drying qualities of wood oil seem to indicate useful characteristics for the preparation of oil for pictures or for varnish or to obtain plastic materials analogous to linoxin or gum oils, it ought to be experimented with in a soap factory. The type of drying oil — linseed oil (with which wood oil is called to compete with more and more) — is generally used for oil paint and plastic materials; it is used on a fairly large scale in the manufacture of soft soaps, especially in the North of France, and in Belgium. In conjunction with linseed oil, wood oil seems "a priori" appropriate to the manufacture of potassic soft soaps, and this has been investigated by the authors.

The sample with which the experiments were carried out had a light amber colour, and possessed a faint odour of rancid oil; it resisted cold and dried readily; its density at 15° was 0.939 and its saponification number was 206. The researches showed that wood oil is saponified a little less easily than linseed oil, that it cannot be used alone in the manufacture of soft soap of normal yield but that it could be used in

(1) For *Aleurites* and their oil, see R., Apr., 1912, No. 66; R., Dic., 1912, No. 179; R., Oct., 1914, No. 809; R., May, 1917, No. 436. (Ed.)

making summer soft soap to a large extent by mixing the linseed oil in considerably larger quantities with it. The experiment made in this way used 70 % of linseed oil and 30 % wood oil.

If the production of the seed increased to a larger and more regular extent in Indo-China it would be possible to extract from the seed in the second heat pressure, a brown oil, as manufactured in Japan. The method of extraction used by the Tonkin natives, leaving a considerable proportion of oil in the oilcakes, would make it possible to utilise for the soap making this brown oil from the second pressure, as oil for paintings and varnish.

CANDLENUT OIL. — “Indian Walnut” or “Candle nut” *Aleurites triloba* Forst = *Al. moluccana* Wild), the “Cây-lai” “May-ly” of the Tonkinese, yields at Tonkin and in Annam an exceedingly drying oil, used, in the same way as wood oil, as lacquer oil. Cooked in the usual way, candlenut oil will give a drying oil comparable to burnt wood oil and superior to linseed oil, from brilliance and drying qualities.

Candlenut oil can be used in a soap factory just like wood oil.

The oil with which experiments were made was straw coloured; density 0.928; saponification number 193, it had a faint rancid odour, and dried rapidly.

The results of these experiments indicate that candlenut oil would doubtless make a summer soft soap, but that is preferable to have a more easily saponifiable and transparent type of soft soap for the final product by mixing this oil with linseed oil or with other “hot-drawn” oils in order to make an oil adaptable for this purpose. An experiment made with 50 % candlenut oil and 50 % linseed oil gave a translucent soap of good consistency.

An experiment for the manufacture of a hard mixed sodium soap from candlenut oil and coconut butter has been made with 50 % of each of these two materials. This mixed soap is more difficult to obtain than coconut soap, but it is of good selling value; it is yellowish white, and lathers sufficiently even in salt water, and is much less hard than coconut soap. To obtain a firmer soap and of higher value, it would be necessary to decrease the proportion of candlenut oil, and to employ, for example, a mixture of 80 parts coconut butter and 20 parts candlenut oil. A soap would thus be obtained which would have similar qualities to those of coconut soap, and it would be more soft.

Summary. — Wood oil and candle nut oils can be used in soap factories: —

(1) mixed with “cooked” oils usually used in making potassium summer soft soap, the proportion of these oils in the mixture rising from 30 to 50 % according to the quality of the soap.

(2) mixed with coconut butter, in proportions of about 20 to 30 % for the manufacture of hard soaps (sodium).

999 - **The Use of Rice Bran in Italy.** — I. MENOZZI, A., NOVELLI N. and FOA, C. (Concorso per l'utilizzazione della lolla di riso) in *Il Giornale di Riscoltura*, Year IX, No. 3, pp. 34-39. Vercelli, March 31, 1919; II. SCURTI, F. and ZAY, C. E. Distillazione della lolla di riso con acidi condensati per la preparazione di solventi dell'acetilcellulosa, in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Part. 5-6, pp. 278-290. Modena, 1919.

I. THE UTILISATION OF RICE BRAN. — The Co-operative Agricultural Consortium of Novara opened in 1917, under the auspices of the Italian Ministry of Agriculture, trials relative to the utilisation of rice bran. The Examining Commission (consisting of the authors of the article) publishes its analytical report which briefly describes the proposed methods, the principal points of which are as follows: *Utilisation of the husk chiefly as fuel*; direct use, or after trituration, or mixed with sawdust or with other fuel, and cementing materials to make an agglomerate; this method surmounts the difficulties of transport of the large and bulky raw material and the increased price of buquetting.

The Firm MARUCCHI AND SON of Florence, suggests that the following be obtained:—

1) combustibile agglomerates with peat, and husk, after pulverisation of the latter or treatment with limewater and the breaking up of the peat;

2) insulating agglomerates always with the broken up turf;

3) imitation wood for flooring and insulating agglomerates by means of breaking up the husk and mixture with the peat turf or cellulose extracted from marsh grass, or husk treated with limewater.

The Firm ERNESTO PULISE of Venice, has proposed the use of the husk for the extraction of cellulose by two methods:— a) maceration with lime; b) digestion in soda solution.

The Firm VIGINO and OLMO of Vercelli obtained by distillation of the husk:— acetic acid and acetone — combustible agglomerate of husk, of carbon and of lignite -- tar -- gas; it has, what is more, suggested its use for the extraction of filter carbon, and also of silicates.

Here are still other proposals:— to use the husk for dry distillation to produce gas, carbon, and various condensable products (acetic acid, methyl alcohol, tar, etc.); to distil the husk with sulphuric acid, in order to obtain acetic acid, furfural, and a carbon residue; and to use the sulphuric acid residue for the manufacture of superphosphates; this method, investigated by M. M. SCURTI and ZAY (Agricultural Chemistry Station at Turin) is described later.

II. DISTILLATION OF THE RICE HUSK WITH CONDENSING ACIDS TO PREPARE ACETYL-CELLULOSE SOLVENTS. — With hydrocellulose (1) after following various proceedings, acetyl-cellulose is prepared, (2) which replaces celluloid and possesses the superior advantage of as well inflammability and slow burning capacity, and can be used, for example, in the making of films, leather paper, impermeable materials, etc. It is used now for the

(1) Cellulose submitted to hydrolysis; this should be with moderation to avoid friability

(2) Usually a mixture of cellulose tri- and quadri-acetate

preparation of imitations of horn, ivory, coral, amber, shells etc. ; and in printing and preparing of textiles ; in the electrical industries and in the preparation of indiarubber, etc.

That which hinders the extension of the use of acetylcellulose, is the lack of appropriate and not too costly solvents. To remedy this, the authors have made experiments and suggest the distillation of rice husk with sulphuric acid as a means of collecting furfural, which, for certain applications of acetylcellulose seems to be the most appropriate solvent. Rice bran (in Italian "lolla", "guscio" "or pulone di riso") has, on an average the following percentage composition: Water 9; fats (ether extraction) 0.5; raw protein 3.5; cellulose 42; ash 18; nitrogenfree extractions 27. These last are composed of pentosans (about 17 %), amyloses, dextrins, tannins, etc. The high content of cellulose (digested with difficulty because it is connected with the hemicellulose by ethereal combinations), and of ash (rich in silica) makes the rice husk harmful to cattle; it causes irritation in the intestines in such a way that its addition to other foods is considered a mistake, and the best use to which it has been put until now is as packing material.

On distilling rice husk with sulphuric acid mixture of furfural (due to the decomposition of pentosans) and of volatile fatty acids is obtained. The rate of reaction depends largely on the concentration of the acid as shown in these data:—

		Sulphuric acid concentration						
		20 %	25 %	30 %	35 %	40 %	45 %	50 %
Yielding {	Acetic acid	2.00%	2.43%	3.18%	8.62%	8.31%	8.52%	8.85%
	Formic acid	0.40	0.57	0.57	0.78	1.09	0.63	0.65
	Furfural	6.60	8.10	9.01	8.30	6.24	5.62	5.82

It goes without saying that, during distillation, it is necessary to maintain a regular concentration by adding water at intervals.

The above data show that:—

1) The highest yield of furfural is obtained by using 30 % sulphuric acid.

2) On the other hand, the maximum yield of volatile fatty acids is obtained by the use of the 50 % acid.

3) The chief component part of the fatty volatile acids is acetic acid.

4) Between the two chief products (furfural and acetic acid) there is no simple relation, so that it is necessary to consider them as products of independent reactions. The following are the bye-products obtained:—

1) Carbonaceous matter at the bottom of the acid liquid.

2) Sulphuric acid concentrated to 50 % in which is found some nitrogen and potash from the husk.

By making a series of experiments, the authors have found that the

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most favourable conditions to obtain acetic acid at the same time as furfural from rice bran is by employing 30 % sulphuric acid.

The ratio of 10 parts of acid to 1 part of husk seems to be the best from an economical point of view. When 3 parts of liquid have been distilled, it is necessary to stop adding water until the other 4 parts have been distilled. At that moment or a little before, furfural formation ceases, whilst the acidity of condensate rises from 30 % to 50 %. By distilling, at this concentration, 3 other parts of the liquid, the remainder of the acetic acid is obtained.

To isolate the furfural and acetic acid, the chief portion of the distillate is neutralised with soda in the presence of phenolphthaleine, and it is redistilled until the aldehyde has been completely eliminated; then the new distillate is submitted to a series of distillations with sodium chloride until the furfural, like a pale yellow, heavy oil, is separated. The residue left by the furfural and the second portion of the distillate neutralised by the soda are both evaporated to dryness and furnish sodium acetate.

The carbonaceous residue separated from the acid partly by decantation, partly by pressure, then washed and dried in the air, had the following composition: - water 16.94 %; ash 40 %; nitrogen 0.21 %; and possessed a caloric value (Mahler method) equal to 3 300° C. This residue serves for the making of agglomerates with 10 to 12 % of coal tar, or better still, of a tarry residue from peat distillation.

The final sulphuric acid shows when analysed (per 1000):— Acidity 497.6; nitrogen 0.4; potash 0.9; ash 5.6. Such an acid could be used directly in the preparation of superphosphates, and the industry of sulphuric distillation of rice husk seems to point to an increase in the manufacture of superphosphates.

The sulphuric distillation of 1 kg. of rice husk yields in practice:— 40 gm. furfural; 110 gm. sodium acetate; 650 gm. carbonaceous residue.

1000 - **Results of the Tobacco Industry in Italy.** — BASSI, F. in the *Giornale di Agricoltura della Domenica*, Year XXVIII, No. 46 p. 271. Piacenza, No. 17, 1918.

According to the description given by the Italian Minister of Finance M. MEDA, in his Report on the administration of the tobacco monopoly in Italy, there are very few instances of state industrial works carried on for a financial purpose, which show such results as those of the Italian administration of the monopoly of tobacco.

In 1860, the receipts for tobacco amounted to 52 millions; in 1868 they rose to 96 millions, and the State transferred the monopoly to a Society which deposited as dues and shares from the net profits, from 70 to 100 millions per annum. In 1885, the State recovered the direct monopoly, and instituted the "General Management of Monopolies". The revenues rose to 170 millions in 1885, then gradually to 190 and 200 millions, and afterwards increased again: 376 millions in 1914—500 millions in 1915-16—603 millions, 1916-17—830 millions, 1917-18. The expenses naturally followed the increase; they varied between 45 and 50 millions from 1865 to 1904, then rose successively to: 81 millions, 1914-15—95 millions, 1915-16

— 123 millions, 1916-17 — 157 millions, 1917-18. The net profits were: 70 % in 1885 — 78 % in 1915 — more than 80 % from 1916 to 1918. The reasons for the rise in net profits are due to the increased demand, and the rise in sale prices. The sales, which included 17 500 000 kg. of manufactured tobacco from 1884-1885, exceeded 20 million kg. from 1911-1912 and reached 25 million kg. from 1917-1918. The improvement of the current brands, and the introduction of new brands have contributed to the increased demand. The largest part of the revenue is devoted to smoking tobacco; tobacco for snuff hardly amounts to more than 7.7 % of the total consumption. Amongst the smoking brands, cigars showed 35 % of the total.

Nevertheless, Italy, in spite of her large tobacco industry, is to a large extent, tributary to the foreigner. Above the 35 million kg. of leaves which are necessary, she imports 28 millions. With cigars, national cultivation only offers the type known as Kentucky; for cigarettes the levantine types of Apulia, Sicily and the Abruzzi. It is hoped to remedy this state of affairs, either by introducing other varieties, both exotic and native, into the old cultivation areas, or by modifying the methods of cultivation, and by looking for new territories suitable for cultivation outside the usual areas. It is this which has taken place, for example, in the province of Lecce, where the production of levantine tobacco has taken such a high rank that the old varieties have been completely forgotten. At present, in Italy, tobacco is cultivated in 51 provinces out of 69. In 1915, it occupied 7 568 ha., which produced 8.5 million kg. of leaves. In 1917, there was a decrease to about 5 000 ha., but for 1918 a harvest of more than 10 million kg. was reckoned on.

1001 — **Relation of Dehydration to Agriculture in the United States** — PRESCOTT, S. C. (Maj. on Detail to Bureau of Chemistry for Dehydration Work), in *United States Department of Agriculture, Circular 126, Office of the Secretary* pp. 10, Washington, D. C., Jan. 25, 1910.

There are now in the United States probably 25 small plants that produce dehydrated vegetables. Several methods are in use, but in all the fundamental principle is the same, namely, to remove the excess of water so as to obtain a product which will not spoil as a result of microbial action or other form of chemical change, and which will conserve the food value of the materials intact. The methods now in use may be classified as follows:—

1. *The tunnel systems* — These consist of long chambers or tunnels into which the prepared vegetables are introduced on screens or racks and through which a strong current of dry air is blown. There are a number of slight modifications in the arrangements of the screens and the method of heating and driving the air, but in the majority of cases the heat is supplied by extensive coils of steam pipe and the air is forced through by means of powerful fans. In some instances the racks holding the vegetables are placed on trucks which run on tracks, so that the material is introduced at one end and delivered in dry form from the other end. In other cases the tunnels have side entrances and the trays are inserted and removed by hand. The weak point of the tunnel system lies in the fact that there is not absolute control of the physical conditions and as a result many vegetables, especially potatoes, are likely to be overheated and scorched, and more or less broken down in their cellular structure.

2. *Kilns*. — The second type of plant may be described as kilns. These are based on the construction of the hop kiln as employed in California and Oregon and to some extent in New York State for the drying of hops and the evaporation of apples. They consist essentially of square chambers with sloping roofs and perforated floors, heated from below by means of stoves or furnaces. The vegetables to be dried are spread on the floor to a depth of 4 to 6 inches and the hot air from the stove passes up through the layer, taking away the moisture, which is conducted from the chamber through a ventilator in the roof. The material on the floor must be stirred up, or turned over, from time to time, and this is ordinarily accomplished by men with shovels. The products of the kilns are rather varied in character. Some are quite satisfactory, while on the other hand others are very much overheated, or may go to the other extreme and be underdried. A lack of uniformity is, therefore, likely to be found in products of this method.

3. *Vacuum process*. — A third type is the vacuum process, which consists of closed chambers with large numbers of shelves heated by steam and with a greatly reduced atmospheric pressure. By the constant application of the vacuum to the process the water vapor is removed and the material dehydrated. This process gives excellent results for many kinds of products, but is rather severe and tends to break down the cellular structure.

4. *Special machines*. — Special types of chambers or machines have been invented and are now in use in a number of places, the air passing through the chamber being conditioned as to bring about a carefully regulated drying. Other special types of machines force the rapidity of drying, but have not the careful regulation which seems to be essential in the preparation of the finest products. As a result, therefore, it may be stated that only in those processes where we have the practically perfect control of temperature, humidity, and rate of flow do we get products which will retain their colour, appearance and flavour, and when soaked in water will return to approximately the normal appearance.

Modern dehydration means the scientific control and co-ordination of the three factors of air, temperature, and moisture.

From the standpoint of agriculture, the greatest advantage of dehydration undoubtedly appears in the stabilisation of crops and conservation of materials. With dehydration the excess of the years of great yield can be stored up and made available in the following year when prices are higher and the crop much smaller. After a short time this would tend to equalise the amount of planting, and, other things being equal, to give year by year a sufficient quantity of food materials at normal prices.

Commercial dehydration in the United States is still in its early stages; there are many problems yet to be determined, attempting to find out which processes are best adapted for general use, whether dehydrated products are deficient in any of the nutritive principles which the fresh vegetables themselves possess, to work out satisfactory methods of storage and transportation by selecting the best types of containers, and to acquaint the consumer, especially in the cities, with the great advantages which are likely to be gained by the use of dehydrated products.

Obviously, dehydration will succeed commercially only in those regions with abundant crops which can be contracted for at planting for a guaranteed price, or in centres having a short haul from the point of production and suitable shipping facilities. If, however, the problem is met scientifically there appears no reason to doubt that a demand will be created and that dehydration will become, as canning has, a great in-

dustry, of immense importance to agriculture, with the further advantage that no tin plate will be required and that the consumer will purchase practically nothing but food material, whereas in the purchase of canned foods he is buying and the railroads are shipping enormous quantities of water.

In order to insure a successful industry, dehydrated products must have the quality which will make them the practical equivalent of the fresh materials. They must be handled in a sanitary manner, be put up in suitable packages, and sold at a price which will make them throughout the year comparable with fresh vegetables. The author believes this can be done, and that dehydration will become the servant of agriculture as well as of the dwellers of the great cities.

1002 - Application of Ultra-violet Rays in Dairies. — *Nederlandsch Weekblad voor Zuivelbereiding en Veeveet*, Year XXV. No. 4, p. 3, 2 fig. Doetinchem, April 24, 1919.

INDUSTRIES
DEPENDING
ON ANIMAL
PRODUCTS

It is known that ultra-violet rays exercise a bactericidal action on the microbes in the atmosphere and in liquids. The loss of cattle, largely caused by microbes, especially by *Bacillus tuberculosis*, has suggested the idea of using the bactericidal action of these rays in dairy work. The Saxon Electrical Society "Elma" (Buhlau) has made for this purpose an apparatus producing ultra-violet rays, and consisting of a mercury lamp in quartz, combined with a system of lamps with metallic filaments giving infra-red rays. This apparatus is mounted on rails, in order that it can be moved to each part of the stable for irradiation of the animals. A special preparation also makes irradiation of the milk possible.

1003 - Investigations concerning Leucocytes in Milk. — KUFFERATH, H. (Chef du Service de Bacteriologie et de Microscopie au Laboratoire intercommunal de Bruxelles), in the *Annales de l'Institut Pasteur*, No. XXXIII, No. 6, pp. 420-424. Paris, June, 1919.

When the hygienic value of milk has to be ascertained, it is necessary to know if it is normal from the point of view of its leucocyte content, and if it does not contain pathological germs.

This is ascertained by centrifugation, which divides the milk into 3 portions: the buttery layer, the skimmed milk and the deposit. With the exception of the microbes contained in the buttery portion, the entire collection of microbes is found in the residue; the various germs in the milk collect at the same time as the leucocytes and the other foreign elements in ordinary milk.

Normally, all milks contain leucocytes in small quantities of from 0.1 to 0.5 per 1000; the residuum obtained by centrifugalisation has a yellowish, sometimes slightly greenish tint. When a large quantity of leucocytes is obtained, for example 1 per 1000 of residue, it is desirable to make a microscopic examination of the latter. The author formerly used the TROMMSDORFF leucocyte tubes, but these tubes showed numerous defects; being fragile, they broke easily in their narrow parts, and necessitated the use of a special centrifuge; the installation was expensive, and, as the centrifuges could only hold 4 tubes at a time, operations were very slow,

as the machine had to be revolved for at least 3 minutes. Besides this, the opening of the narrow part where the deposit accumulated, was very small so that the deposit was of difficult access, and it often happened that the pipette used for collecting purposes, broke in the passage. In the place of this inconvenient model, the author substituted another, by soldering a thermometric tube to a glass tube capable of containing 20 cc. instead of 10. The amount of milk centrifugalised being greater, the deposit is larger and easier to collect and estimate. The lower narrow part of this new tube has two markings, corresponding to 1 and 2 for 1000 of milk (20 and 40 cu. mm. of volume for 20 cu. cm. of milk).

The wide part of the tube is graduated thus :—5–10 20 cc.; above the 20 cc. mark, the tube is continued to a length of 6 to 7 cm., which allows a considerable inclination of the tube without the milk running out. Instead of a special centrifuge, H. KUFFERATH used a large size electric GERBER centrifuge capable of holding 16 tubes at a time; in this way, numerous examinations of milk can be made daily. As all dairies possess a GERBER centrifuge, it would be easy to use for the hygienic examination of milk these leucocyte tubes, which are composed of a much stronger material than the TROMMSDORFF tubes, and the cleaning of which presents no difficulty. When a cow shows an abnormal leucocyte rate, for example above 1 per 1000, a microscope slide should be made of the deposit, and the result after examination should give the necessary indications as to the seriousness of the infection of the milk by microbes.

The consumers have thus the certainty of receiving wholesome milk, and this assurance is especially necessary, when the milk is retailed as aseptic milk, that is to say, it is meant to be used without boiling.

1004 - **Cooling of Milk and Cream.** - GAMBLE, J. A., in U. S. Department of Agriculture, *Farmers' Bulletin*, 978, 16 pp., 8 fig, Washington, May, 1918.

The author deals with the following points in a general statement of practical use in dairies, including the principles and technique of the refrigeration of milk and cream :— The necessity of rapid cooling - Development of micro-organisms in the milk — Principles of refrigeration - - Use of refrigerants which operate on the surface of the cans -- Cooling tanks for the milk - - Use of water from wells or a spring for cooling the milk — Refrigeration of the milk during transport — How to stop adulteration of milk — Cream refrigeration.

1005 - **Cooling Milk and Storing and Shipping It at Low Temperatures.** — GAMBLE, A and BOWEN, G. C., in U. S. Department of Agriculture, Dairy Division, *Bulletin* No. 711, 28 pp., 21 fig Washington, D. C., January 17, 1919

This bulletin reports experimental work covering the relative efficiency of cooling tanks of different construction handled under varying conditions, the most efficient methods of cooling and storing milk on the farm and the transportation of milk at low temperatures to market. The results are summarized as follows:

Milk must be kept at a low temperature (50° F. or below) from the time it is produced until it is consumed if its quality is to be maintained.

Prompt cooling of milk on the farm necessitates the most efficient use of water in both surface coolers and cooling tanks. Ice is needed if milk is to be cooled quickly to low temperatures. Cooling tanks should be covered, protected from the sun, insulated, and of such size as to use ice efficiently. Felt jackets or insulated cans proved to be very effective in keeping milk cold during long shipments in hot weather and in preventing freezing during cold weather.

1006 — **Neufchâtel and Cream cheese; Farm Manufacture and Use.** — MATHESON, R. and CAMMACK, F. R., in the *Farmer's Bulletin*, Nos. 669 and 960, U. S. Department of Agriculture, Washington, July and Nov. 1918.

After describing the characteristics of the Neufchâtel group of cheeses, the authors give detailed directions as to their manufacture and marketing.

The estimated cost of manufacture per 3 oz. package of cream cheese is 4.48 cts, for pimento cream cheese 6.99 cts per jar of 4 oz. and for Neufchâtel cheese 3.33 cts per package (2.507). At current prices for these cheeses and the above costs of manufacture, 100 lb. of 4 per cent. milk should return \$ 9 for cream cheese, \$ 8.85 for pimiento cream cheese, and \$ 8.40 for Neufchâtel.

All these cheeses can only be kept a few days and can be made either in large quantities, or in small quantities in connection with the milk industry, or in the domestic line.

They are very nutritive, and can be used in the preparation of a large number of dishes.

Pasteurisation is carried out at a temperature of 145° F. for 30 minutes, and cooled rapidly at 80° F. for Neufchâtel, and 83° F. for the cream cheese. Add 1% starter or one-half pint for 30 lb. milk, then 8 or 10 drops of commercial liquid rennet or a quantity of powdered pepsin equal to one half of a medium sized pea. In making cream cheese it is advisable to use a very slightly larger quantity of the curdling agent than for Neufchâtel. The two starters should be diluted with a cup of cold water before being mixed with the milk.

The mixture should be well stirred, then the starter added (1½ pint per vessel), and allowed to stand from 16 to 18 hours. After coagulation, the contents of each vessel should be poured out and left to filter undisturbed from 2½ to 3 hours. Collect the curd from the centre of the filter, loosen the filter cover and fold the curd round in the form of a bag; alternate the so-arranged curd with a layer of ice in small pieces, and leave for several hours or during the night.

Compress the curd until each vessel weighs 4.5 lb (Neufchâtel) or 2.5 lb (small cream cheeses). This corresponds to a yield of 15 lb per 100 lb of milk for Neufchâtel, or 18 to 20 lb for cream cheeses; a very considerable yield.

Take the curd from the cloth and add 1 % of its weight of salt, and pass the curd through a mixing machine to spread the salt evenly; pass on to the cheese machine; cover round with tinfoil or thin aluminum and place in specially prepared low cases.

The homogenisation of milk for making cream cheese is not desirable.

The addition of pimiento peppers at the rate of 1 part to 10 or 20 parts of cheese greatly prolongs the keeping quality.

These cheeses should be kept fresh in a temperature of from 50° F. or below until they are eaten.

1007 - **Frozen Meat.** — MARTEL, in *Bulletin de l'Académie de Médecine*, Vol. LXXXI, p. 585 Paris, 1919; summary in the *Journal de Pharmacie et de Chimie* Year III, Series 7, Vol. XX, No. 2, pp. 62-68. Paris, July 16, 1919.

In a communication to the Académie de Médecine, the author examines the scientific and practical reasons which justify the favour with which frozen meat has been taken up by the public, and points out the steps to be taken with regard to meat preserved by artificial cooling.

To start with, it is important to distinguish between the refrigerated meats (cooled down to from +4° to -1° C) and the frozen meats, which are submitted to very low temperatures — 10° to -15° C.

It is to the latter that the term frozen meat is restricted by the public.

REFRIGERATED MEATS — Before the war, the refrigerated meat industry was not limited to the preservation of meats destined for local consumption. In Argentina, New Zealand, and Australia (all producing countries), the export of refrigerated meats (-1° or 0°) had begun to the other hemisphere, after a light disinfectant coating of formalin of the meats and the refrigerator until dispatched, of the hold of the ship, of the cold storage transports, and of the warehouse in the country to which they were destined to be sent.

Refrigerated meats differ from fresh meats in the fact that they are stored in a cold room for several weeks, and have become more tender.

They resemble the so-called "rassisés" meats, and it is admitted that the modifications are due chiefly to autolysis or aseptic autodigestion, and very little to the action of the bacteria deposited on the surface.

The most accurate work on this subject is that of HOAGLAND, BRYDE and POWICK (*U. S. Depart. of Agric., Bulletin* 433, 1917) who have studied the storage of beef at a temperature varying according to the case from -2° to +3° C, and in an atmosphere with 70 to 95 % humidity. The following is a summary of the results obtained: —

(1) *Loss by evaporation.* — Not exceeding 10 % at the end of 177 days.

(2) *Organoleptic properties.* — The muscles became tender. The flavour did not change when the storage did not last more than a few weeks.

(3) *Chemical changes.* — The meats were autolyzed without surface penetration by the microbes. Variations were noted of the nitrogen in its different forms, of the acidity, phosphorus, and fats. The coagulable nitrogen decreased, and the non coagulable nitrogen increased, owing to a diastatic action. This latter process passes from 1.36 % (44th. day) to 37.39 % (177th. day).

At the same time, the amino-nitrogen increased. This change was very obviously influenced by the temperature, and gave the relative mea-

surement of the extent of the autolysis. This nitrogen can pass, compared with the total nitrogen, from 3 to 7 %.

The ammoniacal nitrogen also increases, but gives less exact indications as to the progress of the autolysis.

The acidity, after decrease at the start, increases later.

The variations of phosphorus content seemed to correspond with those of nitrogen, just as in the aseptic autolysis. The soluble organic phosphorus decreased, whilst the inorganic phosphorus increased.

The fats obviously were acidified by hydrolysis. The free fatty acid content of the external and kidney fats rose from 0.46 % (44th. day) to 9.76 % (177th. day), whilst the intramuscular fats showed less variation, showing, in the first case, the overpowering influence of bacterial action and molds.

(4) *Food value.* — In a general way, the preservation for some weeks in a cold room did not entail changes which might suggest the possibility of lowering the food value.

(5) *Preservation.* — These meats at the end of the chilling process were no more changeable than fresh meats; the desiccation of the muscular tissues and the decrease in water content protected them against such changes.

But it should be noticed that the maturation of refrigerated meats behaves in a very different way according to whether very cleanly prepared meats are stored, as in the above experiments, or the meats are more or less polluted as was the case in the experiments which the author carried out with MM. LEMOINE and BORDAS during the summers of 1909 and 1910. In this latter case, there was a combined action of the diastatic ferment in the interior, and of surface microbes, which caused an increased proteolytic action.

Frozen Meats. — Frozen meats, obtained for the first time in France by C. H. TELLIER (1872), judged in 1874 by l'Académie des Sciences, (Report of H. BOULEY) showed changes in composition so negligible that they were considered equivalent to fresh meats.

H. BOULEY (*Comptes rendus de l'Académie des Sciences*, Vol. I, XXXIX, p. 749, 1874) recorded their tenderness and insisted on their eatableness and the possibility of preserving poultry with the digestive apparatus still untouched.

A. GAUTHIER (*Revue d'Hygiène et de Police sanitaire*, pp. 280-283 and 413-436. 1897) was the first to do comparative analyses of fresh meat from the country and frozen meats from Argentine, and came to conclusions which further investigations of other workers have confirmed. He has shown that, except for a weak desiccation (1 % at the most), a small decrease in glycogen, a slight change in the smell of the fats (smell of suet) and an increase of the exsudate, there had been no appreciable change: the same soluble albuminoid, and leucomain contents, the same taste and digestibility, much the same duration of preservation after tawing (92 hours instead of 107 hours).

RICHARDSON either alone (1^{er} Congrès International du Froid, V. II,

p. 261, 1908) or in collaboration with SCHERUBEL, (*Journal of the American Chemical Society*, pp. 1515-1564, 1908) has made a study of frozen meats at -9° and at -12° during periods varying from 33 to 554 days. He only found slight differences between the composition of fresh meat and frozen meat. Besides this, microphotographs of the muscular tissues, show from the histological point of view that the appearance of the frozen muscle is similar to that of the fresh muscle. But transparent cavities were visible down to the interior of the muscular fibres. When the frozen meat was brought back to an ordinary temperature, the muscular tissues reabsorbed the water of the interfibrillary exsudate, and if the operation is performed sufficiently slowly, they regain their position and normal appearance.

The investigations by PENNINGTON (1^{er} *Congrès du Froid*, VII, p. 216, 1908) were carried out in connection with poultry preserved for 2 and even 4 years at -10° . These poultry were dried up but the dehydrated tissues quickly returned to their normal state of moisture after some time in water after removal from the refrigerator. In spite of the long period of preservation, the variations observed with regard to the total content of nitrogen, coagulable nitrogen, aqueous extract, and amino acid nitrogen, seemed small. The soluble nitrogen, the nitrogen of its peptones and amino-bases increased. The fatty matter, under the influence of enzymes and bacteria, turned rancid and changed colour.

The cleanliness of the meat previous to the freezing process plays a very important part in its composition. For one thing, the cold only suspends bacterial action without destroying the bacteria, and they regain all their vitality when the meat is allowed to return to the ordinary temperature; then again, the penetration of the cold is not instantaneous, and researches on the subject in 1909, with the cold storage apparatus of the Laboratoire du Service vétérinaire sanitaire des Halles Centrales, have shown that a side of beef kept at -5°C . requires 30 hours to pass from $17^{\circ}5$ to 0° , and 45 days to reach a temperature of -4.5° . It is possible to understand that with such a slow process, the phenomenon of putrefaction has still time to develop, and this explains certain accidents which can occur when the freezing process is too slow.

The experiments made by the author at the "Halles" in 1912 have shown that it is not correct to affirm that unwholesome meats refrigerate badly or even cannot be frozen. In this respect, they behave like healthy meats. But an important fact resulting from these experiments is that the most unwholesome meats of all, even on the way to putrefaction, cease to smell when they have been frozen.

Under the influence of prolonged cold, many of the muscle parasites (cysticercids) undergo such modifications that death follows after some weeks. A method for the general improvement of meats infected with parasites in use in the countries of Central Europe is based on this principle.

Changes which can take place in stacked cold storage meats are almost invariably caused by molds, which, however, are very superficial and do not take any nutritive value from the meat.

The thawed meats have a better appearance if the air in the "melting" room has been dried by passing over a coke stove. The meats wrapped in clean and dry cloth, renewed two or three times, thaw in 24 to 48 hours, 3 days at the most at 12° or 13°.

In a general way, frozen meats are more tender than fresh meats, especially in summer, and need a little less time for cooking. Nevertheless the somewhat large portions ought to be kept in the oven a little longer, (20 minutes instead of 15 per 500 g.) since the meat is not yet in a state of equilibrium with the atmosphere. In view of preventing the loss of muscular juice during the cooking and retaining all the savoury quality of the flesh, it is recommended to make a brisk fire for roasting cuts. When it is a question of making soup, or boiled meat, boiling water should be put on for 4 to 5 minutes and this should be followed by cooking in cold water. By observing the precautions indicated, dishes are prepared very nearly equal in value to those which would have been prepared with fresh meat of the same quality.

1008 - **Action of Cold on the Smell of Meat.** — MAHUUT, L., in *Le Froid*, Year VII, No. 6, pp. 129-130. Paris, June, 1919.

The author recalls the fact that the "maturity" of meat can only be reached by the action of natural or artificial cold.

This action permits, whilst improving the meat, the development of digestive qualities, and of useful properties which it did not previously possess. It is only at the end of a period of 3 to 5 days that, during the cool season, the meat becomes juicy, and savoury and that roasting gives it an appetising odour.

But, in the summer, the meat ought to be cooked the day after slaughtering, for fear it should not keep, and it is then tough and unsavoury. In the interests of health and from the point of view of taste, only refrigerated or frozen meat should be eaten in the summer. The latter, when it is well thawed, without being of equal value to refrigerated meat, compares favourably with fresh meat.

1009 - **Whale Meat.** *The Patrol Review*, Vol. XXIX, No. 5, pp. 455 Melbourne, May 16 1919.

Whale meat is coming into general use throughout North America, as it already is in Japan. There are on the Pacific Coast of America seven whaling stations in active operation, belonging mostly to United States and Canadian concerns. The Norwegians own a plant at Akutan, Aleutian Islands. There are two stations on Vancouver Island, two on Queen Charlotte Island, one at Bay City, Washington, one at Port Armstrong, and another on the Alaskan coast. Two of these have ample cold storage plants and the others have been developing them as the meat industry enlarged. The same two have big canning equipments, which the others are in process of duplicating. The nearest supply station at Bay City, Washington, put over 300 tons of whale meat on the American and foreign markets last season, including the canned output. These seven stations have reported the capture of 659 whales in 1917, and were expected at the

close of 1918 to have reached the 1000 whale mark. Whale meat in its preparation is treated like other fresh foods, that is, after butchering, it is placed in ice in ship holds, taken to railway ports, and forwarded over the country in refrigerator cars.

The meat extends in great masses from the base of the skull to the tail fin and downwards to the middle line. This meat, all of it of the same quality, amounts, roughly, to 10 tons for each 50 ft. in length of the mammal. Seeing that a whale will go up to 75 ft. in length, there may be 15 tons of solid meat available on one carcase. Even a 50-ft. whale will produce as much flesh as 100 average steers or 500 sheep.

Whale flesh has a similar appearance to that of beef. It is a little coarser in texture, and has a slight flavour of venison. It is usually served in the form of roasts and steaks in America, and it is said that when on the table is very difficult to distinguish from beef. One of the best eating parts is the heart, which weighs a matter of one and a half tons. The tongue will go up 3000 lbs., but it is much tougher than ox tongue, and is not looked on as such a delicacy. Whale flesh has a great advantage over that of cattle, sheep, or pigs in that it is diseaseless. At all events it is said to be. Then, again, the meat is in a solid lump of uniform quality and without bone. Whether it can be put on the market cheaply enough, and in sufficient quantities to compete successfully with beef, remains to be proved. There is nothing to indicate that the supply is inexhaustible. If the meat is too cheap there may be a danger of the mammal becoming exterminated in a short period. It will be remembered that it did not take long to exterminate the American bison.

AGRICULTURAL
PRODUCTS;
PRESERVING,
PACKING
TRANSPORT,
TRADE

1010 - Studies in Lactic Silages with Relation to Microbial Physiology (1). -- GORINI, C., in the *Reale Istituto Lombardo di Scienze e Lettere. Rendiconti*, Vol. LII, Part. 5-8, pp. 193-205, bibliography of 40 works. Milan, Feb. 20-March 6, 1919.

As a result of the connection he found between the fermentations of forage and cheese, the author has undertaken a series of investigations which continues previous work on the subject and which includes at the same time forage silage and the cheese industry.

FORAGE SILAGE. — In previous work on the microflora of silaged forage, the author demonstrated that modern rational silage should essentially aim at suppressing butyric ferments in favour of lactic ferments; he indicated that the principal factor of lactic silos is the limitation of fermentation temperature by means of the timely exclusion of air. In his present work, he has investigated, taking as a basis bacterial physiology, the other practical, almost subsidiary methods which are suggested to favour the predominance of lactic ferments.

Salting. — One of these auxiliary means is the old practice of salting forage silage. Thinking that the utility of this custom was still under discussion and had need of support by bacteriological evidence, the author examined the behaviour of symbiotic cultures of lactic and butyric

(1) See R., Jan. and Feb., 1916, Nos. 109 and 232; R., Feb., 1918, No. 221; R., Feb., 1919, No. 257. (Ed.)

ferments in the presence of sodium chloride, and discovered that salting is inclined to favour lactic silage when it rose to about 5 %, and when it was in presence of an adequate lactic flora.

Low temperatures. — Another auxiliary means is derived from observations on the behaviour of symbiotic cultures of lactic and butyric ferments at low temperatures. These observations having suggested to the author a new method of research with regard to butyric ferments, often so difficult to discover, have helped him to find the reason why this same harmful butyric fermentation is produced easily in insufficiently heated silos, when it is inevitable in strongly heated silos, that is to say above 50° C. ; he recommends then that the silage temperature be kept below 30° C. even with dried up grass similar to that found in Piacenza.

CHEESE DAIRY. — *Salting.* — The stronger restraining influence of the sodium chloride on the butyric ferments in comparison with the lactic ferments, ascertained by the author, has led him to advise that if difficulties are met with in connection with the milk coming from animals fed with silage or with other similarly fermented forage, the manufacture of soft cheese (" grana lodigiano " or " reggiano ", swiss types, etc.), should be suspended, and lean salted cheeses made instead.

Low temperatures. — The singular behaviour of butyric ferments at low temperatures as noticed by the author, enabled him :—

a) to explain the surprising phenomenon — " gonfiore tardivo " — of cheese preferably at a low temperature ;

b) to advise that cheeses ought not to be kept in too cold a place during the time immediately following their fabrication ;

c) to point out the insufficiencies and to notify improvements in the lacto-zymoscopic test intended to check the purity of the milk and its adaptability to be turned into cheese ; he advises an additional test at low temperatures.

SUMMARY OF METHODS DERIVED FROM THE INVESTIGATIONS (1904 UNTIL THE PRESENT TIME) RELATIVE TO THE RATIONAL PREPARATION OF SILAGE. — In practice, it is not possible to avoid the intervention of microbes in forage silages, without having recourse to expedients or anti-septics which afterwards compromise the maturation of the silage.

Microbial intervention ought to be regulated by contending with the germs which can be utilised in the preservation, transformation, and salubrity of the forage. A large number of the harmful germs is eliminated by anaerobic conditions, obtained by means of compression of the silaged forage combined with the impermeability of the pits ; according to the modern improved silage methods (construction, filling, loading and covering of silos).

Nevertheless anaerobic conditions favour the development of two groups of antagonistic germs : the butyric ferments (harmful) and the lactic ferments (useful).

To ensure a rational silage, the task is essentially to contend with the butyric ferments and favour the rapid development and the predominance of lactic ferments, the natural and advantageous preservative

against any harmful and destructive fermentation. In short, all silage to be really successful, ought to be lactic.

Lactic silage was satisfactory to both stock and the cheese dairy (consequently, to the prophylaxis of infectious intestinal diseases of cattle as well as the healthiness of the milk and its derivatives).

The following factors encourage the predominance of lactic fermentation in silage: *a*) the presence of lactic ferments in adequate quantity and quality (eventually obtained by remedying the loss of natural ferments, especially in certain types of forage, by inoculation with selected ferments) -- *b*) a temperature of fermentation slightly above 50° C. (without which the lactic ferments are destroyed and butyric ferments remain active), and not too much below 30° C (otherwise the lactic ferments are hindered from spreading and the butyric ferments develop surreptitiously along with the lactic, to the detriment of the health of the cattle and the purity of the milk, although the organoleptic characteristics of the silaged forage make it appear satisfactory for some time) -- *c*) the withering or semi-drying of the forage (according to seasons and materials); this was noticed by the author since 1908 on farms in the province of Piacenza -- *d*) the final addition of salt (for efficient results, it should be about 1.5 %, in the presence of an adequate lactic flora).

1011 - **Acidity of Silage Made from Forage Crops.** — NEIDIG, R., (Idaho Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XIV, No. 10, pp. 395-409, bibliography of 16 works. Washington, 2 Sept. 1918

It has been found (DOX, NEIDIG) that the quality of maize silage depends chiefly on the nature of the acids which are formed during fermentation. The author attempted to ascertain whether the same acids are developed when other commonly grown crops are used for silage purposes. He shows in a series of Tables, the results of the determinations of acetic, propionic, butyric and lactic acids, as well as the total acidity produced amongst different plants or plant mixtures used as silage, which have been employed in these researches.

The survey of foregoing work and the results obtained by the author show that all the specimens of high-class maize silage which were examined contained lactic, acetic and propionic acids. The non-volatile lactic acid usually occurs in excess of the sum total of volatile acetic and propionic acids. Amongst the volatile acids, the acetic is much in excess of the propionic acid. The plants or mixed silage plants under examination which showed an acid fermentation similar to maize silage, and which furnished excellent forage were as follows: — Oats + peas (in any proportion); oat; peas; wheat; clover; clover + wheat straw. On the other hand, alfalfa and a mixture of alfalfa and wheat straw did not develop an acid fermentation similar to that of maize silage, and did not show any fitness for use as silage.

Butyric acid was always found in spoiled or partly spoiled sample.

In a sample of forage silage composed of alfalfa alone, and collected 9 months after siloing, butyric acid was noticeable, and the alfalfa could not be used as forage.

1012 - **Corn Stover Silage in the United States.** — SHERMAN, J. M. and BECHDEL, S. I., in *Journal of Agricultural Research*, Vol. XII, No. 9, pp. 589-600. Washington, March 4 1918.

The idea of making into silage either green maize fodder or maize whose ears have been removed (corn stover) is not a new one ; but the literature on this subject is scanty, and nothing is known of the nature of the fermentations which takes place during these silage processes.

In order to test the practicability of ensiling maize stover and to study its fermentation processes, the authors carried out the experiments described in the present paper at the Agricultural Station at Pennsylvania. The silo which they used was made of wood staves 16 feet in diameter, and it was filled with 32 000 pounds of stover (plants cut and trampled) to which 66 000 pounds of water was added. The plants had been kept some months before ensiling and were very dry.

Samples of maize thus made into silage were taken at frequent intervals, and examined for general appearance, texture and aroma.

At the end of the ensiling experiment, which lasted 12 weeks, feeding tests were made with cattle, which ate the silage willingly and with little waste. Part of the silage was kept, and at the end of a year and a half it was still in perfect condition. Consequently, the husked maize made into silage with a sufficient quantity of water (2 to 2.5 parts by weight to 1 of stover) undergoes fermentation with the production of an appetising silage similar in aroma and appearance to the maize silage, and of good keeping quality.

To obtain information as to the nature of the fermentation, determinations were made at different stages of the volatile and non-volatile acids, the temperature, and the number and types of bacteria. The total acidity was slightly less than generally found in maize silage ; but the relation between the volatile and non-volatile acids harmonised well. A gradual decrease is noticed in volatile acids and an increase in non-volatile acids. The changes in temperature were similar to those observed in the ordinary silo for maize fodder. Bacteriological observations showed that the rather complex bacterial flora which is present at the beginning of the silage process, gives way during the fermentation to a flora which is almost entirely acid-producing.

In studying the nature of the fermentation, the authors review the actual question as to whether the silage fermentation is due principally to the bacteria or to intracellular respiration ; the results they have obtained tend to support the latter hypothesis, but they consider that conclusions on this point cannot yet be safely given.

Finally, the fermentation which takes place in the maize stover seems to be absolutely identical to that which takes place in the green maize fodder silo, and is carried out by similar factors.

1013 - **New Method of Packing Preserved Vegetables.** — ANZENBERGER, G. in *L'Industrie Française de la Conserve*, Year V, No. 28, pp. 121-125. Paris, June, 1919.

The methods generally adopted for preserving vegetables have many disadvantages which have the result that the taste and nutritive value

of the manufactured products are diminished. The preliminary operation, known as "blanching" which consists in plunging the vegetables into boiling water for a fairly considerable time, is one of the principal causes of waste. This water is considered as waste when the operation is ended. Analysis has shown that it contains carbohydrates and salts removed from the vegetables (1): the value of the latter has therefore deteriorated. When they are later put into metallic boxes, in order to be sterilised, the vegetables are again covered with a certain amount of water: it is in fact necessary that they should be submitted to the direct action of the water vapour under pressure, to guarantee long preservation. At the end of the cooking process, there is still sufficient water for the washing of the edible portions, and, by virtue of the laws of osmosis, they give up to the liquid into which they are plunged, part of their soluble constituents, until equal concentration of the two liquids is reached: that which forms a component part of the vegetative cells, and which surrounds them. Now the liquid contained in the open box is usually thrown away by the consumer, who really uses a food of reduced value.

The new methods destined to cope with the disadvantages mentioned are steam "blanching" and the HUCH process.

In steam "blanching" water is substituted by steam under pressure, and the vegetables are put in an airtight chamber. With steam the vegetables are not immersed in a large quantity of boiling water, and, besides this, it is a much quicker operation than the old system. If the steam contains some of the alimentary principles of the vegetables, it is in relatively small proportions, and the lowering of the nutritive value is much less than before.

The HUCH process reduces to a minimum the loss of the nutritive elements due to osmosis of the vegetables placed in metallic boxes; it consists in the least possible use of the liquid, which could not be completely suppressed; it is necessary to have enough water so that the vegetables, during the heating process, respond to the sterilising action of steam under suitable pressure, and retain afterwards sufficient moisture. But to avoid keeping the vegetables in the liquid until the moment for their use, which is not absolutely necessary, the following device should be used: a box is taken with a double bottom, the upper one perforated like a skimmer and placed at 5 mm. distance from the real bottom. The space enclosed between the two is filled with water and all the upper layer receives the vegetables previously treated with steam. The box is heated in a vertical position, the water vaporises, and the steam comes in contact with the vegetables; the steam condenses in cooling, and the water as a consequence takes its former place between the two layers; the vegetables are thus no longer bathed in the liquid and on the other hand, the presence of a small quantity of water at the bottom of the box retains the required moisture.

(1) See R., May, 1919, No 554. (Ed.)

From control experiments, on the appearance, taste and chemical composition of produce preserved by means of the usual process and by the HUCH process, the advantages of the latter can be clearly seen.

1014 - **Fruits Preserved in Water, Made in the Cold without the Addition of Sugar, Alcohol or Antiseptics; Mechanism of the Method.** — BERTRAND, GABRIEL, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVIII, No. 23, pp. 1162-1164, and No. 25, pp. 1285-1288. Paris, June, 1919.

In July and August, 1918, the author prepared 42 bottles of various fruits preserved in water. These fruits were first washed, either by stirring in water (for example, currants), or by rubbing them with the fingers (plums, apricots,) and repeating the process several times, changing the water each time, in order to clean off as much as possible the dust and outer impurities adhering to the skin. They were afterwards put into bottles with water in such a way that until the moment of closing down the stopper no air bubble was confined in the liquid. A strong rubber washer ensured a tight fitting lid.

The 42 bottles thus prepared underwent a very severe trial, for they remained, at first, without any protection against strong summer heat; then they were kept under shelter from the cold in the winter, and finally they were kept throughout the spring until the beginning of June, 1919.

A fermentation, occasionally active, showed itself in the early days in a certain number of bottles, and liquid was expelled by the gas produced. An examination of these bottles showed that an alcoholic fermentation took place. Others underwent a similar fermentation during the following weeks, but with a slowness generally much more marked. Some bottles went wrong from time to time, for the same reason, in the course of summer, autumn, and even winter; but these cases became, in proportion, more and more rare. Finally, some days before the end of the experiment, that is to say, 11 months after the commencement, 17 bottles remained in an evidently perfect state of preservation, in 3 of which were found only some small gas bubbles, about 1 cc. in total volume, and in 1 of which was found a bubble 3 to 5 cc. in volume under the stopper. In these 4 last bottles, the bubbles had appeared some time before; they had only increased in size with great slowness, and the liquid had remained as clear as in the other 17 bottles.

A slight pressure was noticed, when opening these 4 bottles; probably an alcoholic fermentation was still taking place, but in extremely reduced form. The author had, in fact, consequently only met with this fermentation associated obviously with lactic fermentation, but never putrefactive, butyric, methane and similar fermentations, as might have been feared.

The use of distilled water seemed to be preferable to water from a spring, even if boiled. The most convenient stopper, and perhaps the best, was found to be the "bouchon de cannette" (cock stopper). The jars with a large lid did not ensure sufficient pressure on the rubber washer, and the results were not good. In short, unexpected proof, obtained in the case of apricots, proved that sliced fruits gave much better results than whole fruits.

It is possible then to preserve fruits by excluding air from bottles filled with water, without necessarily adding sugar or anything else, nor

[1013-1014]

even heating them. The yield obtained by the writer's efforts, although satisfactory, would doubtless be improved upon by keeping the bottles in a cellar or in a cool place and not storing for an exaggerated length of time.

As regards the mechanism of the preservation in pure cold water, quite an accessory rôle can be attributed to the pressure exerted by the "bouchon de cannette" (which has given the best results).

It is different with the action of various soluble substances contained in the fruits, and, in particular, the main transformation which takes place in the liquid by owing to of oxidases.

From the moment when the bottles are prepared, the fruits begin to absorb a certain quantity of the water in which they are. Inversely salts, acids, sugars, diastases, etc., spread to the exterior. The water becomes more and more distinctly acid to phenolphthalein and even helianthin, a circumstance unfavourable to the development of the greatest number of bacteria, but compatible to a certain degree with the vegetation of yeasts and lactic ferments, which the writer has also encountered.

At the same time, chemical and diastatic reactions take place, as much in the interior of the fruits as in the exterior solution, and the most important from the point of view of fruit preservation, is that which causes the small quantity of dissolved oxygen in the water in the bottles to disappear (8 to 9 gm per litre of water), and which yet has considerable importance for the fermentations. Every trace of dissolved oxygen is very quickly absorbed, and the central portion becomes strictly anaerobic, and the fermentations cannot start or develop in a normal way.

According to this collection of observations, the chances of success with preserved fruits prepared with cold water, depend theoretically on the following points: (1) the number, nature and degree of vitality of the germs contained in the bottles, germs which are carried by the fruits, and which remain attached to their skins in spite of washing; (2) the acidity of the fruits and, above all, the intensity of the biochemical processes which cause the disappearance of the dissolved oxygen. If the sliced fruits give better results than whole fruits, it is without doubt because the interchange between the water and cell sap being accelerated, the protective actions come into play more quickly than the rate of development of the germs.

1015 - **Preservation of Eggs by Refrigeration after Preliminary Sterilisation.** — *Revue Scientifique*, Year LVII, No. 8, p. 242. Paris, April, 1919.

The methods of preserving eggs in use until these last few years, and consisting either in plunging the eggs into lime water or into a solution of an alkaline silicate, or coating them with fats, such as vaseline, lard or paraffin, are very unsatisfactory methods. The eggs thus treated are often of a bad taste, and are not protected from putrefaction, because they have not been sterilised.

The cold storage method itself, although used on a large scale (in America, for example, for over 2 milliards of eggs each year) is not sufficient to ensure perfect preservation. The cold, in fact, does not kill the ferment-

causing germs which have penetrated through the shell before the operation; it only suspends their development, which starts again immediately the temperature rises to 10°C. In this way the waste frequently exceeds 5 %.

To preserve the egg fresh and wholesome with all its qualities, LES-CARDÉ discovered that it is sufficient to combine refrigeration with preliminary sterilisation in a closed vessel. The eggs are first tested by holding them to the light to eliminate those which are old or cracked; then they are shut in an autoclave attached to a vacuum pump; this operation has the effect of drawing out the gases contained in the little air space in the egg, and those dissolved in the albumin. Following this, carbonic gas and nitrogen, an antiseptic mixture with which the eggs are thus saturated, is introduced into the autoclave. The eggs, now being sterilised, are carried to cold rooms where the temperature is kept between 0° and 2° C. They can remain preserved thus a very long time; at the end of 10 months, the albumin has still retained its whiteness, the air space has remained very small, and the sterilised egg and a fresh egg differ neither in appearance nor taste. This method is already applied in several factories specially equipped for the purpose in France, Belgium and the United States.

1016 - Cold Storage Industry in Madagascar. — *Bulletin de l'Office Colonial*, Year XII, No. 134, p. 116. Paris-Melun, Febr., 1919.

Whilst the cattle in Africa were suffering from plague and double pneumonia the revivalling of the metropolis with frozen meat was temporarily stopped. Madagascar, therefore, prospered in this respect, and 6 factories were installed at Boanamaray, Tamatave, Diego, Tananarive and Antsirabe.

1017 - Preservation of Refrigerated and Frozen Meats. — See No. 1007 of this Review.

1018 - Preservation and Transport of Milk. — See No. 1005 of this Review.

1019 - Dried Fruits: their Preservation and Commercial Value in the United States. — See No. 1001 of this Review.

1020 - Despatch by Parcel Post of Cherries and Small Fruits, in the United States. — HAWBAKER, C. C. and BURMEISTER, C. A., in *U. S. Department of Agriculture. Bulletin* 688, pp. 7, 10 fig. Washington, May 18, 1918.

In 1915, the Bureau of Markets of the Department of Agriculture in the United States, in collaboration with the Post Office Department, sent, as an experiment, a series of parcels of cherries and various small fruits, in different packings for distances within a radius of 240 km. The results show, that with a good method of packing, cherries, strawberries, mulberries, blueberries (*Vaccinium corymbosum*) can be sent this distance; on the other hand, raspberries show a negative result. Cherries ought to be despatched with the stalk. Small fruits should be despatched in several small baskets placed in a case or crate, as ventilation is indispensable during the journey. The authors describe in detail some of the methods of packing suited best to each fruit.

PLANT DISEASES

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINISTRATIVE
MEASURES FOR
PLANT
PROTECTION

1021 - **Measures for the Control of Phylloxera in Italy.** -- *Gazzetta ufficiale del Regno d'Italia*; Year 1919, No. 133, pp. 1539-1540, Rome, June 5, 1919.

By the decree No. 819 of May 15, 1919, of the Viceroy of Italy which came into force on June 6, it was ordered that: --

Art. 1. -- The control of phylloxera by the destructive system is permissible, not only in the cases mentioned in the last paragraph of Art. 6 of the Official Text of Law No. 1474 of August 23, 1917, dealing with phylloxera and with Antiphylloxera Consortia, but also when, after consultation with the Commission, for the Control of Plant Diseases, it is found both:

a) That it is a question of the protection of extensive and important vineyards in which the preparatory work of systematic reconstruction with American vines has not yet been carried out, and consequently the sole aim of direct control is to check the spread of phylloxera.

b) That the Antiphylloxera Consortia of the places interested undertake, by a formal petition to the Ministry of Agriculture to pay and charge to their account the subsidies to be granted to owners of vineyards which have been condemned to destruction in conformity with Decree No. 738 of May 12, 1918.

Art. 2. -- The grants are a charge upon the Antiphylloxera Consortia alone. The Ministry of Agriculture may, however, assist the latter by advancing them the necessary sums, on the condition that the said sums, together with the interest thereon, be refunded within one, or more years, by means of payments made to the officials entrusted with the collection of the contributions to the Consortia.

In order to obtain an advance of the sum necessary for the payment of the grants, the Antiphylloxera Consortium, or Consortia, must consolidate the amount determined by Art. 1 of Decree No. 738 of May 12, 1918, for a number of years that suffices for the re-imbursement of the total sum advanced by the Ministry of Agriculture, and remit the above-mentioned payments to the said Ministry through the President of the Consortium.

Art. 3. -- The amount of the subsidies mentioned in the preceding article is fixed by a Commission composed of three members, these being: the judge of the « mandamento », who acts as President, an expert nominated by the Antiphylloxera Consortium to which belong the vine growers

having a right to the subsidies, and another expert nominated by the proprietor, or proprietors, of the vineyards to be destroyed in that commune.

The said Commission is nominated by ministerial decree, and remains in office throughout the antiphyloxera campaign, that is to say from July 1 to June 30 of the succeeding year.

The expenses of the said commission, together with the fee of each Commissioner, are borne by the Consortia, and shall be fixed by the ministerial decree nominating the Commission.

Should the proprietor, or proprietors, fail to nominate their expert during the fortnight subsequent to the receipt of the communication of the Antiphyloxera Commission, the Prefect shall, by virtue of his office, nominate the said expert.

The decisions of the commission are final.

The technical antiphyloxera delegate of the Consortium, shall attend the Commission in the capacity of advisor.

Art. 4. — The Commission, when fixing the amount of the subsidy to be granted to each proprietor, must not forget that in the majority of cases, it is a question of vines attacked by phylloxera, and of which the production is therefore diminished.

As regards small owners, colonists (*colons*) or tenants, to whom, according to article 11 of the official text of Law No. 1474 of August 23, 1917, the State may grant special subsidies, fixed by the regulations of article 38 of the order regulating the application of the said official text; the commission shall ascertain whether the grants have been made. If they have, the Commission shall deduct the sum already paid from the amount mentioned in the first paragraph of the present article.

Art. 5. — The Ministry of Agriculture is authorised to purchase in private contract the carbon bisulphide necessary for antiphyloxera control and this without any obligation to consult the Council of State even should the sum exceed the limits laid down by Law No. 2016 of February 17, 1884.

Art. 6. — The funds necessary to be advanced to the Antiphyloxera Consortia shall be deducted from chapter 52 of the budget of the Ministry of Agriculture for the financial year 1918-1919, and from the corresponding chapters in the case of subsequent financial years.

BACTERIA AND OTHER LOWER PLANTS.

1022 — Early Varieties of Cotton Escaping the Attacks of the "Boll Weevil" (*Anthonomus grandis*) in the United States. — See No. 882 of this *Review*

RESISTANT
PLANTS

1023 — Varieties of Cotton with Short Lint Resistant to the Boll Weevil (*Anthonomus grandis*) in the United States. — See No. 882 of this *Review*

1024 — Sugar Cane Varieties Resistant to "Sereh" in Java. — See No. 898 of this *Review*

1025 — Coffee Plants Resistant to *Hemileia vastatrix* in Madagascar. — See No. 901 of this *Review*.

MEANS
OF PREVENTION
AND CONTROL

DISEASES
OF VARIOUS
CROPS

1026 - Action of Copper upon Drought Resistance of Vines. — See No. 913 of this Review.

1027 - Rutaceae Resistant to Citrus canker (*Pseudomonas Citri*). — See No. 1028 of this Review.

1028 - The Poisonous Smoke of Explosives a Means of Destroying Diseases and Pests Injurious to Plants. — See No. 821 of this Review

1029 - Patents Dealing with the Control of Plant Diseases and Ennemles. — See of No. 973 this Review.

1030 - *Cystospora Batata*, a Myxomycete Causing Pox or Pit (Soil Rot) of the Sweet Potato in the United States. — TAUBENHAUS, J. J., in *Journal of Agricultural Research*, Vol. XIII, No. 6, pp. 473-480, 2 pl. Washington, D. C., 1918

The writer, who continued on in Texas the researches he had begun at Delaware upon the diseases attacking *Ipomoea Batatas*, wrote this paper with the object of verifying the results obtained at Delaware by J. A. ELLIOTT (who is of opinion that the sweet potato disease called pox, pit, or improperly soil rot, is due to the myxomycete *Cystospora Batata*)⁽¹⁾ and of adding his own observations and the studies he had made on the same subject.

The disease in question, which has already been reported as widespread in New Jersey, Delaware, Virginia, Maryland, South Carolina, Texas, Alabama, Oklahoma, and Kansas, can probably be found wherever the sweet potato is grown, although this has not yet been definitely proved.

Some of the symptoms of pox are thin growth, stunted vines, the pale-green colour of the foliage, the destruction of many of the rootlets, the occurrence on others of numerous brownish spots at various intervals; the destruction of the small roots destined to develop into edible roots; the formation on older roots of a constriction, and the appearance on them of the typical small, dry, darkish, circular, more or less superficial spots. Later, the tissue of the spot dries up, cracks, and falls out, leaving a pox, or pit, whence the name of the disease.

The investigations of the writer have proved that the malady is due to the myxomycete *Cystospora batata* Elliott, and not to the fungus *Acrocystis batatas* E. and H., as was stated by HALSTED.

The disease may be reproduced artificially at will and seems equally active in wet and dry weather, but it is during the latter that it does the greatest damage.

It seems to be spread on the field by the lumps of soil which may adhere to the working tools in wet weather. Evidence also tends to show that the disease is disseminated in the field by rain water.

Pox appears to be a field trouble only, and not to be a disease that develops during the storage of the roots.

It also attacks the Irish potato and the turnip; the beet and tomato are suspected of being susceptible hosts.

(1) See R., No. 596 June, 1917. (Ed.)

C. batata probably hibernates as cysts in the soil. A new species of *Acrocystis* (*A. poolensis* Taubenhaus) is found associated with *C. batata*. The former acts only as a wound parasite and secondary invader. The genus *Acrocystis*, as originally described by HALSTED, is not valid and is non-existent. The fungus *Acrocystis batata* was mistaken by HALSTED for a myxomycete which ELLIOTT has named *Cystospora batata*, the true cause of pox (soil rot). The red varieties of the sweet potato seem to possess the greatest resistance to pox.

Soil sterilisation of the seed bed to control pox is not recommended. Rotation of crops tends to decrease the disease in a sick soil. The suitable rotation remains to be worked out.

1031 - **Diseases and Pests of the Cotton Plant in Italian Somaliland.** — See No 884 of this *Review*

1032 - **Spring Frosts and Infection with Bacterial Tumours or Tuberculosis of the Olive (*Bacterium Savastanoi*) in Italy.** — TRAVERSO, G. B., in *La Nuova Agricoltura del Lazio*, Year VII, No. 150, pp. 94-95, Rome, August 16, 1919.

In June and July, 1919, several cases of bacterial tumours or tuberculosis of the olive (*Bacterium Savastanoi*) were reported from different regions of Central and South Italy to the Royal Phytopathological Station in Rome. This disease caused great anxiety to the olive-growers, because the trees shed their leaves rapidly and became partially withered.

From what the writer was able to ascertain in Apulia (at Torremaggiore), in the Sabines (at Aspra) and in the Castelli Romani, the olives that are most severely attacked, shed all their leaves, and longer or shorter portions of the branches die back. In young trees, it sometimes but rarely happens that the trunk also withers down to its base. Usually, however, the injury is confined to the leaves of branches of from 1 to 3 years of age (especially the lower branches). On carefully examining the young infected branches, it is seen that their extremities are often quite dead withered, longitudinal cracks in the epidermis being usually present. These cracks, which vary from only a few millimetres to some centimetres in length, are numerous, and are much more distinct on young branches that are still green. Here they occur in the form of wounds, the bottom and sides of which are studded with small greenish-yellow tubercles that coalesce and form rugose crusts. These gradually extend, and serve to widen the cracks in the bark where they originated. Sometimes, cracks, with crusts or small tubercles, are even to be seen on the petiole and along the median vein of the leaves.

The tissues of these crusts, when examined under the microscope, are found to be hyperplastic, and to contain the characteristic bacterium of the "bacterial tumours" of the olive tree; this prevents there being any doubt as to the diagnosis of the disease, even should the latter show any unusual characters. Cases are, however, not rare where the rugose crusts finally assume the form of the typical tubercles of the disease.

It is recognised that "tuberculosis" of the olive-tree only develops subsequently to injuries due to various causes (hail, frost, accidental wounds, punctures of insects, blows from a pole, etc). These, by destroying the continuity of the tegumentary tissues, prepare the way for the bacterium, which is itself incapable of making a direct attack.

As the disease is very widespread, it cannot be due to accidental causes, but must be attributed to meteorological agencies, and since hail is out of the question, the writer has come to the conclusion that the determining cause of this malady is the action of the frost to which the trees were exposed towards the end of the winter and in the early spring of 1919.

It was the frost that caused the first injury to the olives (in some cases the complete dying back of the top branches of the tree was due to its agency), the infection with tuberculosis followed as a consequence, for the bacteria found easy access through the cracks produced by the frost, and were able to develop in those tissues that had not been killed. Naturally their development was at first very slow, owing to the low temperature, but it became more rapid and suddenly attained its maximum when the optimum temperature was reached, and thus to the initial injury due to the frost was added the havoc wrought by the bacteria.

This explains why it was only at the end of the spring when the attention of the olive growers was specially attracted by this disease. The damage done to the olivegardens is certainly serious, but the writer is, however, of opinion that no further increase of the disease is to be apprehended, unless any unforeseen circumstances should occur.

It is necessary to give special treatment to the infected trees in order to check the disease as much as possible. All withered cankerous branches of from 1 to 3 years of age should be cut off and burnt immediately. In the case of the larger branches that are attacked by the parasite, it is advisable to wait until the annual pruning time. It is also well to spray with Bordeaux mixture, to which has been added some disinfectant (lysoform, carbolic acid, or formalin in the proportion of from 1.5 to 2 %) and to lime-wash the trunk and large branches with a mixture of lime and sulphate of iron.

1033 - Observations on the "Sereh" Disease of Sugar Cane in Java. — VAN HARREVELD, PH in *Archief voor de Suikerindustrie in Nederlandsch Indië*, Year XXVI, pp 335, 346 Sociëteit, 1918

The writer first of all states that the diseased plants do not recover on being taken to a higher altitude, so that even cuttings coming from the mountains may produce infected plants. He then mentions the fact that all varieties of sugar-cane brought from countries where the "sereh" disease is unknown, such as Tucuman, Cuba, Barbadoes, Hawaii, and Mauritius may show symptoms of the malady when they are imported into Java.

Finally, the writer informs us that the bacteriologist of the Experiment Station has isolated a bacterium which he considers to be the cause

(1) See R. October, 1917, No 96.

of "sereh" disease. This bacterium is identical with the one causing gummosis in Java. (1)

1034 - *Phytophthora Nicotianae*, the Cause of the So-called "Lanas" Disease of Tobacco in Java: Its Treatment. — JENSEN, H., in *Proefstation voor Vorstenlandsche Tabak. Mededeeling*, No. XXIX, 118 pp. Semarang, 1917.

The disease known as "lanas", which has done serious injury to the Vorstenlander tobacco plantations, has been the object of continuous investigation.

The researches carried out at the Wedi laboratory have enabled JENSEN to discover the causes of the evil, and more efficient methods for controlling it than had hitherto been employed. The writer found, by means of new research methods, that the sources of lana infection were to be sought for in the soil, the irrigation water, etc. The presence of the spores of *Phytophthora Nicotianae* in the soil was proved in the following way: — some leaves were cut and placed with their lower surfaces upwards on damp bricks in zinc basins half-full of water. A small quantity of slightly damp soil was thrown upon the leaves and left there for 24 hours. The pieces of leaf were then examined, and the number of brown patches on their surface corresponded to the number of spores that the soil had contained.

The degree of infection was estimated from the number of patches produced by a given amount of soil. In order to determine the presence of spores in water, the writer had recourse to another method. He centrifugalised the water, and infected the leaves with the deposit formed; then he counted the number of "lanas" spots that appeared on the leaves.

The following three different kinds of experiment were carried out at the Wedi Station: — a resistant race was chosen; the tobacco plant was treated with antiseptics; special cultural methods were employed.

D'ANGREMOND has begun a series of experiments on resistant varieties, of which the results will be published later. With regard to the other methods, JENSEN makes the following observations: the individual treatment of each plant is very costly, and takes much time; — the portion of the plant situated at the junction of the air and soil is the most susceptible to infection and this constantly alters owing to repeated hilling up. Nevertheless, a layer of "rupsenlym" (a substance which the writer has sent to Europe, but of which the composition is unknown to him), applied to this part prevents infection for a long time. Bands of hevea latex, and other similar substances, give the same result. During the eighteen days subsequent to the treatment, no sign of infection is seen. A repetition would probably arrest the disease. In any case, plants thus treated give a higher yield than others. Resin soaps, and gelatinous carrageen membranes proved of no use. Before transplanting, the young plants

(1) See R. October, 1917, No. 962. (Ed.)

benefited considerably by the application of "rupsenlym" and permanganate of potassium. In order to prevent the occurrence of this disease in the plantations, Mr. JENSEN recommends the use of stable manure which has been allowed to decompose well, so as to destroy all the *Phytophthora* spores, and the disinfection of the soil by means of chemical substances (the application of lime mixed with sulphate of ammonia is efficacious on account of the ammonia that is liberated). In the upper layers of the soil, good results have been obtained with 50 gm. of powdered lime per litre of soil, whereas in the case of the subsoil, it is best to mix sulphate of ammonia with the lime. The action of sulphate of ammonia when used alone is less noticeable. Formalin and festoform are not to be recommended. Large quantities of permanganate of potassium give satisfactory results, but are too expensive.

Although disinfection by heat has given interesting results when applied to pot cultures, this method cannot be adopted in the plantations. For a long time, flooding the fields was regarded as a good way of controlling *Phytophthora*, but laboratory and field experiments have shown that draining decreases the infecting power of the soil, whilst *Phytophthora* multiplies rapidly in slightly moist soil. It is still an open question whether *Phytophthora* develops very quickly under the latter condition, or whether it continues to live on the ground for some time as a saprophyte.

1035 - *Stemphylium Cucurbitacearum* n. sp. a Hyphomycete Injurious to Cucumber in Indiana and Ohio, United States. — OSNER, G. A., in *Journal of Agricultural Research*, Vol. XIII, No. 5, pp. 295-306, 3 figs., 4 pl., Washington D. C., April 20, 1918.

During the summers of 1915 and 1916, the attention of the writer was called to a peculiar leafspot on cucumber (*Cucumis sativus*) that was doing more or less damage to cucumber fields in the vicinity of Plymouth, Lapaz, Lakeville, Hamlet and North Liberty, Indiana, and also at Bowling Green, Ohio. Sometimes, but rarely, the affection extended to the leaves and petioles.

The spots vary in diameter from 0.2 to 15 mm. The small spots ranging from 0.2 to 3 or 4 mm. in diameter may be circular or angular. Their centre is light yellowish-brown surrounded by a reddish-brown border; the spot is occasionally nearly white.

The larger spots are generally almost white, or tinged with brown, with reddish-brown areas along the veins, and frequently with brownish centres giving the patch a mottled appearance. From these spots, a dematiacea belonging to the genus *Stemphylium* has been isolated. The parasitism of this fungus, as far as the leaves of the cucumber and of *Cucurbita* spp. are concerned, has often been proved by positive inoculations.

It appears that no account has hitherto been published of this disease. The pathogenetic agent is here described as a species new to science, under the name of *Stemphylium Cucurbitacearum*.

High temperatures and a dry atmosphere are unfavourable to the

development of this fungus; consequently, serious trouble may only be expected in cold weather, especially when this is accompanied by abundant moisture.

The fungus hibernates in the form of mycelium in the tissues of the host. It was impossible to discover whether the conidia can survive the winter.

Preliminary experiments have given promise that the disease may be controlled by spraying the leaves with Bordeaux mixture. In addition to this, diseased cucumber vines should be destroyed and crop rotation practised. No work should be done among the plants in wet weather.

1036 *Acrothecium Capsici*, n. sp., a Hyphomycete Parasitic on Capsicums in Italy. — TURCONI, M. in *Rivista di Patologia vegetale*, Year IX, Nos. 8-9, pp. 131-133. Pavia, April, 1919.

The capsicum fruits sent for examination in September, 1918, from Turin to the Cryptogamic Laboratory at Pavia, were found to be affected in two different ways.

On some of these fruits there occurred whitish-yellow livid areas similar to burns, which subsequently became black, owing to the formation of a blackish mould composed of the conidiophores of a hyphomycete that could be identified as the dematia, *Alternaria tenuis* Nees, a very common species living habitually as a saprophyte on very different hosts, and sometimes even as a parasite on many plants.

On the other fruits were to be seen round, or oval, depressed patches 1-3 cm. in diameter, with a slightly concave surface, and of a light-brown colour with a marginal zone of chestnut brown. In these patches there subsequently appeared a fine, almost pulverulent mould, olive-yellow in colour, and formed by another dematia, which the writer considers to be new to science and has named *Acrothecium Capsici*, giving the description of the parasite in Latin.

The alteration producing in the capsicum fruits the characteristic light-brown colour, must be attributed, according to the writer, to the pathogenetic action of the new micromycete, since its vegetative hyphae are always to be found invading the tissues of the pericarp, even in the first young patches. *A. tenuis* never occurs in the latter, whereas it is abundantly developed in the previously mentioned whitish-yellow, livid areas, which are perhaps due to the capsicum fruits having been scorched by the sun.

1037 — Diseases and Pests of Citrus Trees in Argentina. — See No. 805 of this *Review*

1038 — The Susceptibility of Rutaceous Plants to Citrus Canker (*Pseudomonas Citri*) (1). — LEE, H. A., in *Journal of Agricultural Research*, Vol. XV, No. 12, pp. 661-665, 1 pl. Washington, D. C., December 23, 1918.

Inoculation tests with *Pseudomonas citri* carried out at Iamao and at Los Baños, Philippine Islands, as well as at Washington, D. C., upon 24 spe-

(1) See *R.*, July, 1915, No. 763; *R.*, Dec., 1916, No. 1337 (*Ed.*)

cies representing 20 genera of the family Rutaceae, showed that 19 of these species were susceptible to citrus canker in a greater or less degree. It thus appears that this disease is not strictly limited to the genus *Citrus* but has a wide range of hosts among the Rutaceae.

The species *Severinia buxifolia*, *Aegle Marmelos*, and *Balsamocitrus gabonensis*, all close relatives of *Citrus*, may safely be called immune to citrus canker. *Xanthoxylum Rhetsa* and *Triphasia trifolia* seem to be immune.

Chalcas (Murray) *exotica*, *Atalantia disticha* and *Fortunella* (*Citrus*) *japonica*, also closely related to the genus *Citrus*, are strongly resistant to citrus canker.

Clauцена Lansium, *Feronia Limonia*, *Feroniella lucida*, *Chaetospermum glutinosa*, *Hesperethusa crenulata*, *Paramignya longipedunculata*, *Citropsis Schweinfurthii*, *Atalantia citrioides*, *Eremocitrus glauca*, *Fortunella Hindsii*, *Microcitrus australis*, *M. australasica*, *Toddalia asiatica*, *Evodia Ridleyi*, *E. latifolia* and *Melicope triphylla* of different relationships to the genus *Citrus*, all produce positive results when inoculated with *Pseudomonas citri*. Of these, *Clauцена Lansium* and *Feronia Limonia* develop infection very slowly, the others fairly quickly.

Chaetospermum glutinosa shows naturally occurring infections of citrus canker, and in the Philippines, its susceptibility is easily greater than that of *Citrus simensis*.

Fortunella Hindsii occurs naturally in South China, very much isolated from sources of citrus-canker infection. The abundance of cankers found on such trees gives rise to the theory that this species may have been an original wild host from which citrus canker spread to cultivated species.

1039 - The Susceptibility of the Meliaceae *Lansium domesticum* to Citrus Canker (*Pseudomonas Citri*) (1). — LEE, H. A., and MERRILL, E. D., in *Science*, New Series, Vol. XLIX, No. 1273 pp. 199-200, Lancaster, Pa., May 23, 1919.

Recent researches have shown that the agent of citrus canker (*Pseudomonas Citri*) is not closely confined to the species of citrus as hosts, but attacks plants of a large number of other genera of the Rutaceae.

Still more recently, inoculations of *Ps. Citri* outside the Rutaceae have been attempted. The first non-rutaceous plant employed was *Lansium domesticum*, a Meliaceae cultivated in the Philippines for its edible fruit. Needle punctures made through a suspension of *Pseudomonas citri* placed upon the midribs, the petioles, and main stems of this tree produced the appearance of the lesions of citrus canker. Control inoculations made with river water under the same conditions gave a negative result.

Pseudomonas citri has been re-isolated from such lesions.

Inoculations have been repeated several times, and each time there was produced a reaction not shown in the controls. These results have been obtained both on potted trees and trees growing under field condition. The experimental conditions were at the optimum for canker development.

(1) See No. 1035 of this Review. (Ed.)

The results warrant the statement that *P. citri* upon stem tissue of *L. domesticum* produces a reaction not shown in control inoculations.

These results are recorded by the writer with the view of throwing fresh light upon the character of the canker organism.

It is conceivable that a chain of circumstances in the field might produce extreme optimum conditions that would lead to infection of highly resistant host plants, which from observation under ordinary conditions would be regarded as immune.

Lesions on such hosts then would be capable of serving as sources of re-infection to citrus plants.

1940 - ***Bacterium Juglandis*, Injurious to the Walnut in South Africa.** — DODGE, R. M., in *The South African Journal of Science*, Vol. XV., No. 6, pp. 407-412. The Cape, 1919

The presence of walnut bacteriosis has recently been reported from various districts in South Africa (Cape Colony, the Orange Free State, the Transvaal, and Natal). This disease is produced by *Bacterium Juglandis* Pierce, and was first described as occurring in California, hence its popular name of Californian walnut blight. It attacks only the tender growing parts of the tree, such as the young nuts and branches, the young leaves and petioles.

On the branches the infections usually make their appearance near the growing point; the first indication of infection is a small dark green water-soaked area which gradually increases in size; the central portion becomes discoloured, and finally black. As the shoot becomes hard and woody, the active development of the disease is checked, the whole diseased area then turns black, and in many cases, the affected tissues shrink and crack.

Infection on the leaves and petioles begins in a similar way, forming small water-soaked spots more or less angular in outline, which coalesce when numerous and form large discoloured areas. When the veins are attacked the leaflets become puckered and deformed in various ways.

The bacteriosis on the leaves and branches usually does very little injury, and the disease would be of slight economic importance, if it did not attack the young nuts, which it usually infects near the stigma while still quite small. As in the case of the leaves and shoots the first evidence of infection is the water-soaked appearance of the tissues, which subsequently blacken and become somewhat sunken. The micro-organism also penetrates inwards, and frequently injures the kernel of the nut. Lateral infections often occur where two nuts are in contact. When the nuts are attacked at an early stage in their growth, large blackened areas develop and the nuts drop sooner or later. Later infections, which occur when the nut has almost reached its full size, generally take the form of small dark spots scattered over the surface, and as a rule do not penetrate very deep, since the tissues have by this time begun to harden.

The lesions on the twigs are chiefly instrumental in carrying the disease over from one season to the next. The micro-organism is transported from

branch to branch, and from one tree to another, by wind and rain. The leaves which are attacked early in the season are probably one of the chief sources of infection for the fruit.

The bacterium has been repeatedly isolated from infected leaves and nuts, and in its cultural and morphological characters is identical with *Bacterium Juglandis*. No difficulty was experienced in obtaining a pure culture of the micro-organism, and numerous infections were produced by spraying young walnut trees with a suspension of the culture. From the leaf infections thus obtained, the bacterium was re-isolated, and a second series of trees inoculated with positive results. None of the controls became infected. The writer had no opportunity of infecting young nuts, but cultures from the nuts readily infected the leaves.

The disease only becomes severe when there is a considerable amount of rain and a large number of cloudy days while the nuts are forming. The bacteria infect the young tissues through the stomata, and in the presence of moisture the motile organism moves freely over the surface of the nut and invades the tissues through these natural openings.

Hence, it is probable that this bacteriosis will cause serious trouble in those regions of South Africa where there is a heavy rainfall in the spring and early summer. In less humid districts, considerable loss will probably be experienced in exceptionally wet seasons only.

In districts where the rainfall is small and mostly in winter, no serious trouble is to be expected, and fruit growers intending to plant walnuts in the more humid districts would do well to obtain their trees from localities where *Bacterium Juglandis* is yet unknown.

1041 — *Ophiodothella Fici*, n. sp., an Ascomycete Living on *Ficus aurea*, in Florida. — BESSEY, E. A. in *Mycologia*, Vol. XI, No. 2, pp. 55-57, 1 Pl. Lancaster, Pa., March, 1910.

A description of the new dothideaceae *Ophiodothella Fici* Bessey, which was frequently found by the writer in Florida in 1907 and 1908 upon the leaves of *Ficus aurea* near Larking (Dade Co.) at Little River and other localities in the neighbourhood of Miami.

1042 — *Rhacodiella Castanea*, a Hyphomycete Causing Black Rot of Chestnuts (1). — PEYRONEL, B. in *Le Stazioni sperimentali agrarie italiane*, Vol. LII, Parts 1-2, pp. 21-41, 4 Plates. Modena, 1910.

The results of further and exhaustive researches into the morphology of the fungus producing the black rot of chestnuts have convinced the writer that the fungus studied by PEGLION, BAINIER and himself was in all cases the same. The agent of black rot is therefore to be identified with *Harziella Castaneae* Bain. The writer has, however, already pointed out, that this hyphomycete cannot be retained in the genus *Harziella* (2). He has thus created the new genus *Rhacodiella* for it in the family *Dematiaceae*.

(1) See *R.* Feb., 1917, No. 203, and *R.* March, 1919, No. 394. (Ed.)

(2) See *R.* Feb., 1917, No. 203 (Ed.)

The chief characteristics of this genus (named *Rhacodiella* from the resemblance between its mycelium and that of *Rhac. cellare* Pers.) are a highly developed, brown, ramified and septate mycelium; indistinct conidiophores; flaskshaped sterigmata occurring singly, or more frequently arranged in irregular whorls; endogenous, globular, hyaline conidia disposed first in clusters and subsequently in chains.

The writer gives a description in Latin of the new genus and the new species, to which he assigns the name of *Rhacodiella Castaneae* (Bain.) Peyronel.

As regards the probable origin of the infection, the observations made by the writer, and the information obtained during the last few years, prove the truth of his suggestion that the chestnuts are attacked while still upon the tree and not after they are stored. Probably, the infection takes place during the flowering season, especially in very wet springs, when the conidia are produced in large quantities, or when the perfect fructifications of the fungus develop upon the diseased chestnuts.

The writer considers that the best way of hindering the spread of the disease is to avoid storing chestnuts in damp places. They should be kept in a well ventilated store-room, and in such a manner as to prevent the mycelium of *Rhac. Castaneae* passing easily from one chestnut to another. If any chestnuts are seen to be covered with the characteristic felt-like mycelium, they should be removed and destroyed.

If it is a question of large quantities of badly infected chestnuts, it is a good plan to plunge them into a vessel full of water, when the diseased ones will nearly always rise to the surface. The rest should be carefully dried and fumigated with sulphur dioxide in order to kill the numerous conidia of *Rhacodiella* and other hyphomycetes adhering to their surfaces. The chestnuts should then be spread out in a dry place.

1043 - Diseases and Pests of the Coconut Palm in the Province of Madras, India.

— See No 891 of this Review

WEEDS AND PARASITIC FLOWERING PLANTS.

1044 - *Icerya hyperici*, n. sp. a Coccid living on *Hypericum perforatum*, a Weed in New South Wales, Australia. — FROGGATT, W. W., in *The Agricultural Gazette of New South Wales*, Vol XXX Part 7, pp 470-472, 1 Plate. Sydney, July, 1914.

About fifteen years ago, *Hypericum perforatum* was reported to be rapidly spreading in south-eastern Victoria; it has gradually invaded New South Wales, also (especially the Mudgee and Tumbarumba districts).

For this reason, in 1918, the Federal Bureau of Science and Industry included this plant in their list of field pests, and began making enquiries in England with a view to the importation on a large scale of the beetle *Chrysomela hypericum*, Forster, which is a parasite of the weed in question and of other species of *Hypericum*, which also attack the leaves of these plants. It might be possible to confine *Chrysomela hypericum* to its

host, but as an immigrant in a new land, there is some danger of its turning its attention to some more succulent Australian plant.

In the meantime, the writer has announced his discovery at Mudgee, in April, 1919, of an indigenous enemy feeding upon the roots and the lower portions of the twigs of *H. perforatum*. This parasite is a coccid belonging to the genus *Icerya*, and has proved to be a hitherto unknown species, which is described in this article under the name of *I. hyperici*. The parasite has already become well-established on the plants in the Insectarium, the tiny larvae being clustered all over the stems. It is too soon, of course, to judge as to its value as a natural enemy of *H. perforatum*, but it seems likely that an indigenous coccid, which is very reproductive and lives sheltered by the soil on the roots of its host-plant, is likely to be quite as effective (if not more so) than a strange beetle from another land, which possesses much lower powers of reproduction and feeds in the open on the foliage where it is exposed to many enemies.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1045 — **The Exact Determination of Some Pests of Tobacco in Java.** — JENSEN, H., in *Proefstation voor Vorstenlandsche Tabak*, Vol XXXV, fig. Semarang, 1919.

Recent researches, and the more careful attention devoted to entomological questions during the last few years, have often shown the lack of accuracy of many of the scientific names hitherto given to insects of economic importance.

It is evident that the microlepidopteron called "dikbuikvlinder", which is generally very injurious to the tobacco plant (as its larvae produce swellings on the stems in the form of galls) should henceforth bear the scientific name of *Gnorimoschema heliopa* Low. KONINGSBERGER mentioned this insect for the first time in scientific literature, and called it *Lita solanella* Boisd., on the authority of the lepidopterist SNEIJLEN, who thus identified, though with some hesitation, the moths sent to him. From that date, this microlepidopteron has been known in West Indian scientific literature under the above name. In 1915, however, KRUCHENIUS found out that this was a mistake. He stated that the name given to the "dikbuikrup" in the West Indies was incorrect, and that the insect should be called *Gnorim. heliopa*.

The true *L. solanella*, at present named *Phthorimaea operculella* Zell., is a mining caterpillar living in the leaves of certain *Solanaceae*, the tomato, *Solanum Melongena*, *S. carolinense*, and also tobacco being especially attacked, this little caterpillar is also met with in potatoes. So far, the presence of the true *L. solanella* in tobacco leaves has never been actually determined in the West Indies.

The life history of the latter insect differs very greatly from that of *Gnorim heliopa*; its eggs are laid on leaves, and its caterpillars are leaf-miners and pupate on the surface of the ground.

In foreign entomological literature, the two species have always been regarded as quite distinct. The Americans call the "dikbuikvlinder"

tobacco stem-borer, whereas the true *Lila* is known under the names of the "potato tuber moth", "tobacco leaf-miner", or "tobacco splitworm". In order to settle the question as regards Java, JENSEN obtained from Washington authentic specimens of *Lila*, and compared them with the "dikbuikvlinder" of the West Indies. The differences between the two species were very distinct; they differ in: a) the number of hooks on the posterior legs of the caterpillars; b) the thickness of the hair on the tip of the abdomen of the chrysalis; c) the presence or absence, in the male larvae, of a tuft of hairs near the base on the anterior margin of the posterior wings; d) the male genital organs.

The female moths of the two species are more difficult to distinguish. In neither is there a tuft of hair on the posterior wings, and the venation of the wings is precisely similar. It is only in young moths that have just emerged, that there is any difference in design and habitat; older moths lose these characteristics, which explains the mistake formerly made by SNELLEN.

The researches of JENSEN have shown, that the "oleoer poepoes", also a very serious enemy of the tobacco, ought in future to be known as *Chloridea (Heliothis) assulta* Guen. According to KONINGSBERGER, who first wrote of this insect, "oleoer poepoes" includes two distinct species: *Heliothis peltigera*, and *Hel. armigera*. The difference between the two lies in the markings on the wings of the moths, that is to say, the presence, or absence, of two dark spots on the inner face of the anterior wings. On examining numerous moths that he had reared, JENSEN however, found many intermediate forms.

He sent some material to be investigated at Washington, and HEINRICH determined the specimens as *Hel. assulta*. BAINBRIDGE FLETCHER's figures in one of his last publications dealing with *Hel. obsoleta (armigera)* and *Hel. assulta*, show that this tobacco pest in Java must be identical with the last named insect.

The "oleoer kawat", the larva of a beetle of which the adult form is known in the Vorstenlanden as "tjidal" or "kotoe", has also hitherto passed under the wrong name of *Opatrum depressum* Fabr. JENSEN's attention was called to the fact that under the name "tjidal" were included a larger and a smaller species termed in general *O. depressum* and *O. acutangulum*. FAIRM however, could find no difference in size between the two forms. Specimens were dispatched to Washington, but the specialists there were unable to arrive at a decision. It is certain that the Dutch West Indian species are neither *O. depressum* or *O. acutangulum*. The "oleoer kawat" should be known provisionally by the name of *Gonocephalum (Opatrum) sp.*

1046 — On the Life History and Bionomics of *Myxus ribis*, an Aphis injurious to *Ribes* in Great Britain. — HAVILAND, M. D. in *Proceedings of the Royal Society of Edinburgh*, Vol. XXXIX, Part I pp 78-112, 9 figs. Edinburgh, 1919.

Myxus ribis Linn. (red-currant aphid) on *Ribes rubrum* is dimorphic in respect of certain features of the antenna, and of abdominal and wing dimensions. The nature of the food, whether healthy, or blistered by the

attack of the female fundatrix, seems to be the determining factor of this dimorphism. The form of the aphid coming from healthy leaves is probably identical with *M. whitei* Theobald, and *M. dispar* Patch. *M. ribis* is a migratory species, and in summer colonises certain *Labiatae* and other weeds; but this migration is not obligatory, and the entire life-cycle may be passed on currant.

On its summer host plant, this species has been previously described as *Phorodon galeopsidis* Kaltenbach.

There is a decline in fertility in the later part of the summer among the forms remaining on *Ribes*. This is caused by a lower birth-rate, and not by the shortening of the life of the parent.

This decline, together with the attacks of predaceous and parasitic enemies, accounts for the frequent disappearance of the species from *Ribes* in August and September.

Both sexual forms may be produced and eggs may be laid on either host-plant. Males transferred from *Labiatae* to *Ribes* can fertilise the females on the latter plant.

MEANS
PREVENTION
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1047 - Parthenogenetic Reproduction of *Apanteles glomeratus*, a Parasite of *Pieris brassicae*. — GAILLIER, Cl. in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXII, No. 24 pp 1000-1002 PARIS, July 26 1919

The writer has proved experimentally, that the female of the braconid hymenopteron *Apanteles glomeratus* is capable of laying parthenogenetic eggs.

There is no question in this species of a physiological cycle, since the males and females always exist simultaneously in nature, but merely of an accidental occurrence, which may, however be of great importance in case the female does not happen to meet with a male. A large number of parthenogenetic eggs are laid.

Fertilisation by the male does not influence the manner in which the female recognises and attacks the small caterpillar of *Pieris brassicae* any more than it induces any difference in the cocoons. These are identically the same, whether they are produced by parthenogenetic, or sexually generated individuals.

1048 - *Mutya grandis*, a Rhynchote Preying on the Macrolepidopteron *Papilio thoantiades* in Argentina (1). — *La Prensa* Buenos-Aires, April 7, 1919

M. A. CABALLERO of Buenos Ayres has observed that the larva of *Papilio thoantiades* ("gusano del naranjo") is fiercely attacked by a rhynchote (fam. *Pentatomidae*), which C. E. Blanchard has identified as *Mutya grandis*, a very voracious insect possessing great power of resistance.

M. CABALLERO intends to study the life-history of this predaceous insect, which he believes also attacks other lepidoptera that are injurious to agriculture.

(1) See *R.*, September, 1918, No 1065 (Ed.)

1049 - Experiments in Controlling the Moroccan Cricket (*Doclostaurus maroccanus*) in France (1). — VAYSSIÈRE, P in *Comptes rendus des Séances de l'Académie des Sciences*, and Half-Year, Vol CLXIX, No 5 (August 4, 1919), pp 245-248. Paris 1919.

At the request of the General Council of the Bouches-du-Rhône, and of the Technical Commission instituted at the Ministry of Agriculture (Direction of Sanitary and Scientific Services) for the purpose of employing war products in agriculture, new experiments in controlling *Doclostaurus maroccanus* were undertaken, in 1919, at Crau, where this orthopteron had done still more damage than in 1913. Flame-throwers, suffocating toxic gases, and poisoned baits were employed

(1) Flame-throwers (Army models P3 and P4), in which heavy coal-tar oil is used as the inflammable substance, give remarkable results when directed against masses of acridians resting on the ground or walking. A single charge of a flame-thrower containing one dozen litres will, if well directed, clear a surface of over 200 sq metres

The most practical method of using these missiles is to throw two, or three, at once, when they explode simultaneously covering an area of 100 sq metres in an instant

(2) *Suffocating toxic gases* — A mixture of oxychloride of carbon and chloride of tin, which had been considered during the war as very poisonous to mammals, produced no effect upon very numerous swarms of Moroccan crickets, though these were subjected to the action of highly concentrated gas at distances from the place of emission varying from 0.10 m to 4 m. The gas did great damage to the vegetation in the neighbourhood. On the other hand, spraying with a 25 %, or still better, with a 50 % emulsion of chloropicrin (2), gave excellent results. Every cricket upon which there fell a single droplet from the sprayer (an ordinary one made of tinned iron) was attacked by complete paralysis of the wings, this affection spread to the hind legs, and the insect died in a few seconds, the rings of the abdomen showing a rapid rhythmic antero-posterior movement. It is interesting to note that some of the crickets thus killed were infested with the larvae of a parasitic dipteran (*Sarcophaga* ?) which, after the death of their host, came out to pupate. Further, the chloropicrin, in the concentrations used in the experiments, only temporarily destroyed the vegetation, which recovered after a few weeks. Researches are still being carried out near Miramas

(3) *Poisoned baits*. As the fields in the neighbourhood, especially the meadows, were irrigated every week, and no animals were turned out to graze from the beginning of March to the end of October, the writer, in his experiments of controlling *D. maroccanus*, used a soluble arsenic salt for his poisoned baits. He employed one of the formulae generally used in America containing only 0.500 kg of arseniate of sodium per 12 kg

(1) See R., of April 1919, No 51. Cfr also *La lutte contre les sauterelles dans les divers pays* Int Inst of Agric Rome, 1916 *passim* (Ed.)

(2) See No. 1050 of this Review (Ed.)

of bran. In the early morning the mixture was spread broadcast over the meadow covered with crickets, the latter being still torpid from the cold of the night. Twelve hours later, a large number of insects lay on the ground poisoned, and forty-eight hours after, the number of dead insects amounted to over 80 %.

From the results obtained, the writer is of the opinion that it will be possible in future to keep down the swarms of *D. maroccanus* and of acridians in general. To this end, when the young larvae appear it is necessary to use : 1) flame throwers in the case of all infected areas where there is no danger of fire (Crau and similar desert areas) : 2) sprayings with a 50% solution of chloropicrin in zones where flame-throwers would be dangerous : 3) arsenical baits in irrigated fields which are not grazed by animals.

On account of the toxic, or dangerous, nature of the substances recommended, it is necessary that the State should assume the responsibility of the organisation of these operations, and should be assisted by associations of land-owners such as the Defence Syndicates (*Syndicats de Défense*).

1050 — The Highly Toxic Effect of Chloropicrin upon Certain Lower Animals, and the Possibility of Employing this Substance for the Destruction of Parasites. —

BERTRAND, C. in the *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*. Vol. CLXVII, No. 14 (April 7, 1919), pp 742-741 Paris, 1919.

The great increase that has taken place during the last few years in the number of caterpillars and other plant parasites, owing to a combination of natural conditions as well as to lack of labour and the scarcity of insecticides, induced the writer to try whether any of the lachrymatory or suffocating substances used in during the war, could be employed for controlling these agricultural pests.

Chloropicrin is one of these substances, and has proved especially suitable for the purpose, for it is an industrial product that can now be obtained in large quantities, it keeps well, and, as will presently be shown, it is extremely effective.

It is produced by the action of chloride of lime upon picric acid, or upon the residue left after making that acid, and is a liquid with a high refractive index, and a density of 1.666 at + 16° C. Its boiling point at a pressure of 766 mm. is + 112.3° C. Chloropicrin, however, evaporates very easily, as it has a high vapour tension ; the writer found this to be 30.2 mm. at + 15° C. It is not inflammable. It is only slightly soluble in water ; according to a determination made by the writer only 1.65 gm. dissolve in a litre at + 18° C. When much diluted in the air, chloropicrin has a slightly aromatic and pungent smell ; when more concentrated, it soon becomes extremely irritating to the eyes and respiratory passages. It has therefore both lachrymatory and suffocating properties, and further, produces a violent cough on inhalation. Certain precautions are necessary in handling chloropicrin, but on account of its aggressive nature, it is quickly perceptible, and when much diluted is innocuous, therefore it is much less dangerous to man than hydrocyanic acid for instance, for which, perhaps, it could sometimes be used as a substitute.

The author tried the effect upon a number of insects of chloropicrin diluted in the air in known proportions, and carried out a series of experiments, in order to ascertain the minimum fatal dose for each species. In these experiments, he took into account the length of time that the animal was exposed to the vapour, for, to a certain extent, the toxic action increases with the length of the exposure.

The method used was as follows — by means of a capillary pipette giving small drops of which the weight has been determined by the balance, a known amount of chloropicrin was dropped into a wide mouthed litre, or two litre, flask. The latter was then corked, and well shaken, in order to insure the vapour being equally diffused throughout the air in the flask. After a quarter of an hour, the animals were introduced, from three to five being enclosed at a time in a little bag of fine gauze which was suspended in the toxic atmosphere by means of a thread fixed between the neck of the flask and the cork. When the animals had been exposed for the given length of time, they were examined, and if they proved to be alive, they were taken out placed on the leaves which formed their usual food, and kept under observation. If the insects were aphids, a piece of the stem of the host plant covered with its parasites was put into a small bottle containing water, instead of into a bag, so that neither the plant, nor the insects, should suffer from evaporation, and the bottle was lowered down into the flask by means of a string.

The insects experimented upon were the caterpillar or larvae of lepidoptera (the vine, pyralid the endemis of the grape, the lackey moth [*Bombyx neustria*], of trees etc.) the larvae of hymenoptera (the poplar sawfly) and aphids (the aphids of the Japanese spindle-tree).

From the total data obtained from these experiments it was found that the aphids were killed either immediately, or in some hours, by being placed for from 5 to 10 minutes in an atmosphere containing only from 1 cgm. to 2 cgm. of chloropicrin per litre. A concentration of half this strength was also very efficacious, at least as regards the larvae. The latter stopped feeding, lost their strength and power of movement, and finally died in from 24 to 48 hours after their exposure to chloropicrin vapour.

There is thus every reason to suppose that fumigating or spraying with chloropicrin (either in the form of an aqueous solution, or an emulsion) might prove a good method of controlling certain parasites of cultivated plants.

1051 - An Aphis Injurious to *Vicia atropurpurea* in the United States. — See No 826 of this Review

1052 - Pests of the Cotton Plant in the State of São Paulo, Brazil. — See No 883 of this Review

1053 - *Diacrisia virginica*, Macrolepidopteron Injurious to Cotton and Other Plants in Texas, United States. — MITCHELL, J. D., in the *Entomological News*, Vol XXX, No 7, pp 101-104 Philadelphia, July, 1910

In July, 1917, larvae of *Diacrisia virginica* were observed all over Vic-

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toria County, Texas, in limited numbers, feeding on various species of weeds. At Placido, they attacked three fields of cotton, and on about one acre in each field defoliated the plants, leaving the green bolls on the stalks.

In May, 1918, severe infestations occurred in Victoria and adjoining counties, and many complaints came in of cotton being damaged. The writer spent some time in observations in Victoria and Calhoun Counties.

The larvae were found feeding upon a large number of wild plants and shrubs, and also upon the following cultivated crops *Gossypium hirsutum*, *Zea Mays*, *Cucumis Melo*, *Medicago sativa*, and *Arachis hypogaea*. They eat all garden truck.

The first infestation appeared on weeds in pastures and on the road sides. Where the weeds were plentiful, the caterpillars did no damage to crops, but where wild plants were scarce, they invaded the fields, especially cotton fields.

When the caterpillars are very young, they are killed by spraying them with Paris green and lime, but when they are large, no poisons or repellants seem to have any effect upon them.

Some farmers claim to have kept caterpillars out of their fields, until a fair yield was assured, by dusting ahead of them with pure Paris green, others saved a paying crop by going along the infested side and handpicking and killing the caterpillars. The damage to cotton by *Diacrisia virginica* in Victoria and Calhoun Counties, in 1918, is claimed by farmers to be from 25 %, to total destruction. On an estate in Calhoun County visited by the writer, the destruction of cotton on 65 acres was found to be complete. The fields on this land and the lands adjoining were free of weeds. The only parasite bred from *D. virginica* is *Eremotylus arctiae* Ashmead.

The writer gives information concerning the life-history and habits of the parasite.

1054 - *Solenopsis geminata*, an Ant Injurious to Tobacco in Java. — ROEPKE, W. in *Leemann*, Year XXIX, Part 7, pp 192-201, 6 pl Batavia 1908

The writer mentions some of the distinctive characters of the "tabaksmier" (*Solenopsis geminata* F.), without, however, giving any particulars as to its mode of life, which so far has not yet been thoroughly investigated.

Workers and Soldiers. - These are of a fine rich red brown colour. The abdomen is sometimes of a darker or lighter tint of grey, especially along the posterior margin of the segments. The head is of a much darker red-brown than the rest of the body, this is most noticeable in the large-headed soldiers. The entire body is smooth and shining, there being few hairs upon it.

The little workers have rather small heads, the latter are longer than they are wide, and become somewhat narrow towards the upper portion. The scape of the antenna is too short to reach the posterior part of the head. The nine other segments forming the funicle are but little longer than

the scape. The extremity is composed of two segments, and forms about $\frac{2}{5}$ of the funicle.

The thorax is free from the projecting spines, teeth, and sharp points met with in many other formicidae. The legs are very slender, as in the case of all other species of ants, the anterior legs have also a little tuft at the end of the tibia, while the so-called spurs are wanting on the intermediate and posterior legs. The little tuft serves chiefly for cleaning the antennae. Seen from above, the two segments of the abdominal stem are of about the same width, and are not supplied with spines, teeth, or other similar weapons. The abdomen seen from above is oblong and oval, the first segment being wider than the three succeeding segments taken together. Sometimes the sting projects somewhat from the extremity of the abdomen. The length of the little worker calculated from the extremity of the abdomen to the mouth parts varies from 3.5 mm. to 4 mm. The soldiers are larger. Their heads are especially long and broad in comparison with their bodies, the posterior margin is much notched and, a deep, pointed median suture runs along the whole length. The anterior part of the thorax is stronger, in order to support the heavy head. The abdomen is slightly thicker. The length of the largest soldiers is from 6 to 7 mm. The results of twenty measurements showed that there was no marked difference between the workers and soldiers in *S. geminata*.

Females or Queens.—These are distinguished from all the other classes by their larger size and the greater development of the abdomen. Young unmated females have two pairs of wings. After pairing, they lose their wings and remain wingless for the rest of their life. The females are about 8 to 9 mm. long.

Males.—These are relatively large, and are easily recognised by the special structure of their antennae which have no terminal segment, the scape and funicle being alike. The antennae of the male consist of 12 segments. The males keep their wings. The length of the male *S. geminata* is about 6.5 mm. Although the soldiers look very ferocious on account of their large heads and powerful jaws, they are never the first to attack.

Control.—It is impossible to destroy the ants' nests in a systematic manner, as the individuals live too much dispersed. Good results seem to have been obtained by isolating the seed beds of the tobacco by means of running water. If there is no running water at hand watering the seed beds with an emulsion of petroleum and soap is the best remedy.

1055 - Insect Injurious to Seeds of Cinchona Sown in Nurseries, in Java. — See No. 905 of this Review.

1056 - *Antonina zonata* n. sp., a Coccid Found on *Ternostachyum attenuatum* in Ceylon. — GREEN, L., in *The Entomologist's Monthly Magazine*, Third Series, Vol. V (LV), No. 50 (663), pp. 175-176, 1 fig. London, August, 1910.

A description of the new species, *Antonina zonata*, which lives on *Ternostachyum attenuatum* at Pundaluoya, Ceylon. The adult females of this coccid are clustered in the axils of the smaller branches of the host-

plant. They are seldom actually exposed, but are almost invariably enclosed in certain shelters constructed over them by ants (*Crematogaster dohrni*). The position and globular form of the insects give them the appearance of sessile berries growing upon the plant. The male puparia are usually concealed beneath the stipules of the host.

1057 - *Cyrtognathus forficatus*, a Beetle Injurious to the Vine in Morocco — TH. LÉV. A., in *Le Progrès agricole et viticole*, Year XXXVI, Vol. LXXI, No. 23, pp. 544-545, 2 figs., Montpellier, June 8, 1919

The larvae of the longicorn beetle, *Cyrtognathus forficatus* L., which usually attacks the roots of the dwarf palm (*Chamaerops humilis*) in Morocco, have also been found destroying the vine there. Vigorous stocks already bearing grapes, which had been planted in the spring of 1917 on land cleared the previous year, were found, in 1918, to have been completely cut in two at 6 or 7 cm. below the surface. In all, there were 21 stocks attacked by these larvae on one hectare. The damage was not very great, but there were only a few clumps of dwarf palms on the land. As nearly all these clumps harboured the parasite, much more injury would have been done if the palms had been more numerous. Up to the present date, 1919, the writer has found but one fresh case.

The larvae only attack vines in default of other food, and exist solely where *Cham. humilis* grows.

As a method of control, the writer recommends that vines should be planted on land free from these palms, or where they are few in number. If this is not feasible, as long a time as possible ought to be allowed to elapse between clearing and planting; the larvae should be collected at the time the ground is cleared, the vines should be carefully watched, and the larvae removed directly they make their presence known.

1058 - Some Rhynchotes that Infest Citrus Trees in Australia. — FROGATT, W. in *The Agricultural Gazette of New South Wales*, Vol. XXX, Part 5, pp. 325-330, 8 figs. Sydney, May 2, 1919.

A description giving the life histories of the following rhynchotes which, having deserted their respective original plant hosts, now infest citrus trees in various parts of Australia: --

- 1) Green spined orange bug (*Biprorulus bibax*);
- 2) Painted Capparis bug (*Stenozygum personatum*);
- 3) Painted horehound bug (*Agonoscelis rutila*).

When orchard trees are badly infested with swarms of immature bugs, as is often the case, a kerosene or oil emulsion mixture well sprayed among the foliage will kill larval forms. Jarring the branches, after placing a sheet on the ground under the tree, will often bring down these pests in large quantities when mature, this should be done in the early morning when the bugs are semi-torpid and inactive. The rhynchotes thus caught, can be thrown into a bucket or tub of boiling or cold water containing a little kerosene.

1059. *Citriphaga mixta* n. g. and n. sp., a Beetle Attacking the Rutacea *Atalantia glauca* in New South Wales, Australia. — FROGGATT, W. W., in *The Agricultural Gazette of New South Wales*, Vol. XXX, Part 4, pp. 261-267. 4 figs. Sydney, April, 1910.

Atalantia glauca, popularly known as the native lime, is one of the very few plants related to the citrus family which are indigenous in Australia. The writer has received many requests for its seeds from the United States Department of Agriculture with the view of cultivating this rutacea as a suitable stock upon which to graft the more delicate oranges and lemons. Its fruits, which are small and have an acid lime flavour, make a refreshing drink when crushed in water to which sugar has been added.

A. glauca grows plentifully in the Morea district, in New South Wales, where the writer discovered a large number of the half-grown trees were badly damaged by borers. These were found, by means of breeding experiments carried out by Mr. LEE, to belong to a new genus and new species of longicorn beetle for which he suggested the name of *Citriphaga mixta*.

The eggs are deposited in the bark a few inches above the ground; the larvae form a large open bore in the trunk and cause a considerable gumming of the damaged wood. The larval stage can be estimated as lasting about 10 months, and the pupal state as lasting from a month to 6 weeks.

A description is given of the larva, the pupa and the adult beetle. A technical description of the new genus and new species is also appended.

1060. *Taeniothrips inconsequens*, a Thysanopteron Injurious to the Pear Tree, Discovered in Ontario, Canada. — ROSS, WM. R., in *The Canadian Entomologist*, Vol. II, No. 1, p. 81. London, April, 1919

The pear thrips (*Taeniothrips inconsequens*), which had hitherto not been recorded as occurring in Ontario, was found by the writer in the spring of 1918, on pear-trees in a large orchard near Beamsville. Fortunately, the number of these insects was extremely small, and as far as could be seen, they had done little damage.

1061. - *Tylenchus musicola* n. sp., a Nematode Parasitic on the Bluggoe Banana in Grenada, British West Indies. — 1) NOWELL, W., in *West Indian Bulletin*, Vol. XVII, No. 3, pp. 177-179; 2) COBB, N. A., *Ibid.*, pp. 170-182, 2 figs. Barbados, April 7, 1919.

I. — In May, 1918, the existence was recognised in Grenada of a serious and wide-spread affection of the banana known there as the bluggoe, and used extensively as a temporary shade for cacao.

It appears that the disease may develop in plants of all ages, though its presence is most evident to the casual observer in those that are approaching, or have actually reached, the fruiting stage.

A common characteristic is the drying of the outer leaves, and then of the partly developed bunch, the fruits of which often dry to a hard blackened condition when only 2 or 3 inches long.

In every instance, the root system was partly or ~~entirely~~ dead, or else dying. The dead roots were either totally black, or black between the cortex and the central cylinder. The outer part of the bulb from which the roots arose, presented the same black disorganised appearance, and this was repeated to a lesser degree on the bulbs and roots of young suckers arising from the diseased parent.

Mr. NOWELL further examined spirit-preserved material (bulbs and roots) coming from the two infected localities in the island.

The affection has the general appearance of a fungoid disease, but neither hyphae, nor bacteria, were present to an extent, or with a uniformity, suggesting more than a saprophytic rôle. On the other hand, Mr. NOWELL found nematodes and their eggs in all the material examined.

As regards the control of the disease, the first essential is the complete avoidance of the use of suckers from infected clumps for planting material. Where land is badly infested, some other crop should be substituted. Observations will no doubt be made as to whether more intense cultivation will enable plants to throw off the disease. It has been reported in a communication of December, 1918, that the plants in one infected district showed a considerable measure of recovery during the more favourable conditions of the wet season, presumably because more rapid root development had kept pace with the progress of the infestation.

II. - Dr. COBB, to whom Mr. NOWELL sent for identification the nematode found in the infected material, gives a detailed description of it under the name of *Tylenchus musicola*. He states that it is a new species, and until some proof is found to the contrary, this eelworm must be regarded as the cause of the disease in question.

The new nematode is very closely related to *T. similis*, Cobb, *T. penetrans* Cobb, and *T. pratensis* de Man.

1062 - Pests of the Avocado (*Persea gratissima*) in Guatemala. — POPENOB, W., in *United States Department of Agriculture, Bulletin* 713, pp. 33-36, 1 pl. Washington, D C., April 17, 1919

A small beetle, *Conotrachelus*, n. sp., is the most destructive of all the parasites infesting the avocados (*Persea gratissima*) in Guatemala. The larvae of this pest are sometimes found in the ripe fruits sold in the market. There is no external sign denoting the presence of this curculionid, but if a fruit is cut in half, the seed is seen to be more or less perforated by wide borings containing a dozen or more larvae varying in colour from white to rose. It is rare for the larvae to attack the pulp of the fruit directly, but they often ensconce themselves between the seed and the pulp, causing a change of colour in the latter. In some of the avocados examined, the seed was so greatly altered by the borings of the larvae, that it was actually reduced to a pulverent condition. It is obvious that the fruits attacked by this insect are useless.

It appears that *Conotrachelus* is of common occurrence in Guatemala. Very little is yet known of its life-history. Once it has excavated its galleries, it abandons the fruit and pupates in the soil, the adult beetle emerging a few days later.

From the standpoint of the damage produced, the next parasite of importance after this beetle is a rhynchote representing the family *Psyllidae*. The latter pest, which is probably *Trioza koehleri*, is very common in the district of Antigua, and of fairly frequent occurrence in various other regions. It produces on the upper surfaces of the leaves numerous long, conical galls, which no doubt exercise an unfavourable influence upon the tree. Probably, in addition to the species mentioned, there are other gall-forming *Psyllidae* which are responsible for the injury to the leaves.

In *Persea* seeds that have remained some days on the ground beneath the trees, large numbers of *Caulophylus latinasus* have been found. This beetle is also often found in seeds coming from the market where they have been kept for two or three weeks. It bores small galleries in the seeds.

The larvae of a small lepidopteron (*Stenona* sp.) have been found in some avocados bought in the market at the town of Guatemala; they make borings in the seed and are similar in size and general appearance to *Conotrachelus* larvae, but the damage they cause is not so great. The presence of these larvae is revealed by a little round hole on the surface of the seed.

Numerous scale-insects attack *P. gratissima* in Guatemala, but cases of serious infestation are rare. At Almolonga, near Quetzaltenango, a tree was found which was very badly attacked by *Pulvinaria floccifera*. Other scale-insects reported from different regions of Guatemala are *Aspidiotus lataniae*, *A. subsimilis*, *Chrysomphalus dictyspermi*, *Chrys. perseae*, *Chrys. personatus*, *Chrys. scutiformis*, *Diaspis boursduvali*, *Pseudoparlatoria ostreata* and *Lepidosaphes mimosarum*. As for the fungi parasitic on *Persea gratissima*, *Colletotrichum gloeosporioides*, *Diplodia perseana*, and an undetermined species of *Fusarium* have been recorded.

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

1063 — **Agricultural Conditions in Cyrenaica.** — MANGINI, A., in *L'Agricoltura Coloniale*, Year XIII, 1st Half-Year, No 2, pp 75-91 Florence, Apr 30, 1919

GENERAL. — Along the coastal zone of Cyrenaica wherever irrigation is possible vegetable gardens and orchards are cultivated on intensive lines. The interior plateau is covered with good pastures and well watered, so that stock grazing is of great importance and cereal crops are widely grown. From November to April or May, barley and wheat are cultivated, i. e. the pastoral and grain growing systems of agriculture of the nomadic or seminomadic type prevail. The factor which limits stock-rearing is the availability of watering places; the barley and wheat crops, which give very varying yields, serve to feed the farmers' household and also the stock.

Except for rare weeding, the Bedouin's agricultural work is limited to the operations of sowing and harvesting. Sowing is done broadcast on unworked land and the seed is covered by scratching the surface of the soil with the native plough, which is light, cheap and easily drawn even by the commonest means (generally a camel); moreover this plough has the advantage that it can be used without difficulty on land recently soaked by rain.

These systems cannot solve the problem of economising moisture as much as possible, which is most important in dry countries like Cyrenaica. The author touches on the question of the chief climatic and soil characteristics of the colony, so as to bring out the difficulties which will have to be faced and overcome before dry-farming of cereals on a large scale can be undertaken with chances of success.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

CLIMATE. — The Government Agricultural Bureau has established an extensive system of thermo-udometric stations in the regions most interesting from the agricultural point of view, but the stations have not been working long enough yet for the data which they have gathered to be sufficient to define exactly the climate of the district. It is known, however, that the year has two seasons: — the rainy season, when only un-irrigated herbageous crops are grown, and the dry season, which destroys all herbaceous plants and stops tree growth. From one year to another there are marked variations (from 250 to 500-600 mm.) in the rainfall; in the lives of the natives these variations are recorded as years of scarcity or of plenty. The rainfall between October and April is likewise very variable.

The climate is windy; sometimes sea winds cause damage, but plants suffer most from the "ghibli", a south east wind, often very violent, dry, scorching, and loaded with sand, which lasts whole days on end, especially during May, June, August and September. The early (March-April) "ghibli" are the most dangerous as, when they come at the flowering period, they sometimes completely prevent pollination and cause crop failure. On ripe or nearly ripe ears the "ghibli" causes a sudden drying up and consequently heavy losses during harvesting operations. The simplest means of defence against this wind consists in selecting very early species and varieties of grain (barley is earlier than wheat) and in sowing early.

SOIL. — Calcareous red earth formed on the spot from the rock below is most general; the limy crust is of variable depth but is usually very thick. Small particles form the greater portion of it and give rise during the dry season to deep crevices in the soil. This soil is not very permeable and water accumulates on the surface; after rain it easily forms a crust.

The long period of complete drought creates conditions very unfavourable to bacterial life which can show activity only during a few months in the year. The big deep roots of a natural variety of thistle, which remain in the ground after the plant is dead, are widely used by the natives as fuel. Some leguminous plants (peas, beans) grown in gardens hardly ever have nodules on their roots, while in the case of naturally-growing leguminous plants which the writer has had occasion to examine (genus *Vicia*, *Lotus*, *Melilotus*, *Medicago*, *Trifolium*, *Lathyrus*, *Astragalus*, etc.) the nodules exist and are often numerous. It is probable that beyond a certain depth no life can exist in these soils, which are mostly virgin and uncultivated.

On the plateau there are numerous more or less vast depressions which often have the appearance of great plains and in which vegetation profits by the water coming from the surrounding higher ground and by the lesser intensity of the winds.

On the south side of the plateau in the plain lying south of Benghazi, towards the Syrta (Barka and Beda), etc., are the native "white soils", mellowed than the red, often very deep, and more porous to water and air. Between the red and the white soils there are many intermediate types.

On account of their great depth and uniform structure, both the red

and the white soils offer conditions which, on the whole, are favourable to dry farming.

BARE FALLOW. — Ploughing during summer and autumn and repeated surface operations during the year mean the accumulation and conservation in the soil of rain water, to the benefit of a crop following the bare fallow. In Cyrenaica, this is a necessity to assure constant crops, especially as it allows of reasonable hastening of sowing on dry ground and under the best conditions. The climate of Cyrenaica is not very favourable to the use of bare fallowing (the "ghibli" is the main obstacle), but on the other hand the soil offers better conditions. The very extensive depressions in the colony, preferred by the natives because the crop in them is more certain, combine excellent conditions for the effective use of the fallow.

MACHINES AND MOTIVE POWER. — The first attempts at cereal growing undertaken in Cyrenaica during the seasons of 1918 and 1919 have shown that many ploughing implements coming from Italy or abroad meet the special conditions of the colony very imperfectly. For example, it is stated that, for first working of the soil, even only on the surface, the mould-board plough is of little use on account of the great haulage force required and the facility with which the parts get broken and especially because the turning over of the sod is not without grave danger in new countries. The disc cultivator, which is more substantial, easier to draw, and which opens up the soil without turning it over, is much more suitable. Acmé and jointed harrows are not fully efficacious in almost virgin soil; it is more profitable to use disc harrows, which have already been used with advantage in the colony for work on bare ground under fallow (they have the advantage of leaving the tilth arranged in furrows which are less affected by the "ghibli") and harrows with adjustable mobile tines for harrowing done during the period of growth. In addition, drills for widely spaced rows and head-reaping machines are needed.

Draught animals are scarce and not economical, so that mechanical haulage machines are an absolute necessity for the colony. Already good results have been got from the use of Mogul tractors for summer and autumn ploughing. On the other hand, under present conditions, direct mechanical haulage gives poor results for sowing, as tractors need dry ground in order to work well. In this respect the bare fallow, sown before the great rains, will permit of a wider and more efficient use of tractors.

Of draught animals, the mule thrives fairly well in the climate of the colony, and much better than oxen. It may be that the camel will be useful for this purpose in the future, but at present the few camels available are scarcely enough to keep the small caravan-trade going.

There is plenty of flat ground, without obstacles and not very stony, which would lend itself easily to the use of mechanical power.

EXPERIMENT STATIONS FOR CEREAL GROWING. — If the use of bare fallows by means of implements which fulfil the requirements of the farmers is recognised as possible, then the problem of the economic gain presents itself, and it is of first importance. It is easy to determine part of the factors in the calculation, but others, and these are the most

important (*e. g.* the yields of the crops), will not be established until after a sufficient number of years, on account of the great variations they are liable to undergo. Hence the need for a long period of experiment before the growing of cereals on a large scale in the colony can be advised.

CONCLUSIONS. -- In the agricultural future of the plateau of Cyrenaica the growing of cereals as an industry, with the bare fallow and a wide use of mechanical power, will very probably assume great importance, but much experimenting is required first, methodically carried out and lasting over a sufficiently long period, to demonstrate the technical possibility and the economic suitability of this undertaking. The solution of these problems could be entrusted to one or more stations for experiments in cereal growing which should be set up as soon as possible in the colony.

The favourable conditions centred in the plateau as regards stock raising, especially sheep, point a sure way to the colonist, who will be able to await with greater tranquillity the establishment of new plantations of trees and the practice of cereal growing for his own and his family's requirements, while basing the income of his farm on live stock and their products. It is over this period that the activity of the Government Agricultural Stations should be spread. New and definite horizons could be brought into view for the expansion of agriculture in the colony.

1064 - **Activity in Agricultural Development in Mesopotamia.** — See No. 1242 of this Review.

RURAL
HYGIENE

1065 - **Treatment of Malaria with Trypanoblué.** — GROS, H., in *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 7, p. 434-442. Paris, July 9, 1919.

Trypanoblué has long been used in the treatment of certain illnesses in animals caused by protozoa.

Mr. GUY MAURICE, Inspector General of the State of San Paulo (Brazil) Veterinary Services, proposed, in August, 1917, to resort to the use of this colouring matter against malaria, and he managed by means of this agent to render the cattle in the state of Rio immune to bovine malaria, an animal disease which he compares to malaria.

The writer has experimented with the proposed method and his results enable him to state that: — 1) trypanoblué, in sub-cutaneous injections and in doses of 20 to 40 cm. of a 1 % solution, lessens the fever in malaria which has lasted about a month; 2) trypanoblué does not prevent the multiplication of the hematozoa; 3) it does not even cause a temporary sterilisation of the patient, as does quinine; 4) it is inferior to quinine, and, used by itself, it should be entirely rejected in the treatment of malaria; 5) it may be employed without inconvenience and even perhaps sometimes with advantage in association with quinine.

1066 - **Identity in the Geo-botanical Conditions for the Pupation of *Glossina*.** — SCHWETZ, J., in *Bulletin de la Société de Pathologie exotique*, Vol. XII, No. 5, pp. 234-238. Paris, May 14, 1919.

The systematic search for and the discovery of the haunts of the *Glossina* are of relatively recent date. The writer spent three years (1916-18) in the comparative study of the habits of five species of *Glossina* (*Gl. pal-*

palis, *Gl. fusca*, *Gl. brevipalpis*, *Gl. pallidipes*, and *Gl. morsitans*) and succeeded in finding numerous pupae of all these species in the Belgian Congo (province of Katanga).

He has frequently found pupa resting-places common to two and even three species of Glossina, whence it appears that the different species seek the same or similar places for their larvae, i. e. places having the same favourable conditions for the hatching of the perfect insect.

The essential and absolutely necessary conditions in a pupa-bed for all species of Glossina are: — (1) *dry loose ground*; (2) *shade*.

Besides these primary conditions there are others of secondary or less importance. For this reason, beside ideal places or "true resting-places" i. e. where pupae are very numerous, pupae are very often found scattered in any spot providing the essential requirements, as local necessities also force the Glossinae to a certain adaptation. Thus, at first sight, there seems to exist some difference between the resting-places of different species of Glossinae, but this apparent difference is due solely to the fact that the various species frequent places which provide a special type of vegetation which suits them.

As *Gl. palpalis* is found only along wooded water banks, its pupae are generally found on these banks. This species prefers a sandy spot for egg-laying, but when there is no pure sand, deposited by water, it is satisfied with sand mixed with earth, and even with earth alone provided it is very soft. Also the larvae of *Gl. palpalis* are deposited only in dry seasons, as in a rainy season the shores are often inundated. The pupae of *Gl. fusca* and *Gl. brevipalpis* are found in similar places, in true resting-places and with pupae of *Gl. palpalis*. The *Gl. morsitans* and *pallidipes*, while not avoiding the neighbourhood of water, have their habitat preferably in vast moderately-wooded regions, and also *Gl. fusca* and *brevipalpis* may leave the vicinity of water. Under such conditions a search for the pupae is much more complicated, but even then there exist favourite places. The latter consist of the large trunks of fallen or uprooted trees lying horizontally or not very much inclined, touching the surface of the ground or, better still, lying a few centimetres above it. The under part and borders of these fallen trees fulfil all the requisite conditions: sun and rain do not penetrate there and, consequently, the ground is neither damp nor hard; and the Glossinae find there a good vertical support near the ground for the time when the larva is expelled. The writer has found about 200 pupae of *Gl. fusca* under one of these fallen tree trunks.

The shrub or herbaceous undergrowth is also of importance for pupa resting-places; it should not be too tufted, for then the fly cannot hover freely enough to choose a place to lay its eggs, while the presence of numerous small roots does not make the ground very soft. The complete absence of undergrowth is equally unfavourable, for then the insect has not the necessary support when the larva is expelled. Fallen trees, however, while preferred most, do not monopolise the resting-sites, and the writer found numerous pupae of all five species in the most varied places and corners: hollow trees, alive or dead, containing a little sand or earth; the lower

edge, slightly raised, of *Elaeis* palm trunks; under the base of a sloping ant-hill in a little soft ground, etc.

In short, the pupae of the *Glossina* are found practically on a level with the ground, immediately under the bed of dead leaves and humus.

1067 - **Vegetables in Rural Domestic Economy, in Italy.** — TAMARO, D. (Royal Agricultural School of Sassari), in *L'Alimentazione*, Year I, No. 6, pp 59-60. Milan, June, 1919.

Taking as basis the statistics for 1914 relative to the production of the principal food-stuffs in Italy, and allowing for imports and exports, the writer estimates the average annual consumption per inhabitant of the principal foods in the following manner. — wheat 172 kg., maize 50 kg., rice 15 kg., potatoes 45 kg., dried pulse 16 kg., meat 16 kg., fresh vegetables 100 kg., fruit 44 kg., seasoning (oil, butter, fats) 22 kg., sugar 4580 kg., a total of 484 580 kg. The daily ration per inhabitant therefore contains the quantities and the composition shown in the appended table, from which it results that the average ration of the Italian people quite corresponds to what hygienists recognise as normal, in spite of the very low consumption of meat in comparison with other peoples.

Nutritive elements contained in average daily ration in Italy.

FOODS	Daily consumption	Proteins	Fats	Carbohydrates	Salts (ash)
	grammes	grammes	grammes	grammes	grammes
Wheat (bread)	473	36.18	1.32	237.49	5.62
Maize (polenta).	137	7.61	2.00	48.00	2.50
Rice	41	3.96	0.54	30.71	0.33
Potatoes	123	1.94	0.00	25.75	1.35
Dried pulse	43	9.03	0.58	22.89	0.21
Meat.	43	9.03	0.64	—	0.48
Fresh vegetables	247	3.37	1.72	30.52	5.48
Fruit	120	0.52	0.22	15.37	1.92
Seasoning (oils and fats)	60	—	60.0	—	—
Sugar	12	—	—	—	—
Totals	1299	71.67	61.02	422.73	17.99

Normal ration for adult man: — Protein 50-60 gm. — fats 50-80 gm. — Carbohydrates 350-400 gm

Vegetables play an important part in the average ration, and being the cheapest of the foods they ought, according to the author, who in this agrees with the hygienists, to be consumed to a greater extent, up to 300 grammes daily per head

Vegetable growing is of great interest in rural and domestic economy, while agriculture finds in these plants a crop yielding the highest returns, and domestic economy a food of excellent quality and very cheap.

1068 - **Biological Values of Wheat and Almond Nitrogen.** — MORGAN A. F., and HEINZ, A. M. (Division of Stousehold Science, University of California, Berkeley), in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 2, pp. 215-222. Baltimore, feb. 1919.

In 1909 Karl Thomas attempted to compare the biological values of various protein foods by a comparison of the minimum quantities of their food nitrogen which suffice to maintain equilibrium in the adult body. His work (*Arch. Physiol.*, 1909, p. 219) has resulted in a good deal of discussion but few confirming experiments. American authors (Rose and Cooper McCollum, Simmonds and Parsons) have criticised the brevity of his nitrogen balance periods as well as the arbitrary formulae used by him in the calculation of the percentage efficiencies reported. These formulae are:

$$\frac{\text{Urine of N- free diet} + \text{balance}}{\text{N absorbed}} = \text{biological value}$$

$$\frac{\text{Urine of N- free diet} + \text{fecal N} + \text{balance}}{\text{N ingested}} = \text{biological value}$$

As final result, the average is taken of the two values so obtained.

The writers estimate that the Thomas method may be accepted as indicating to some degree the relative protein values of those foods, taking into account, however, the fact pointed out by McCOLLUM, SIMMONDS and PARSONS that the nitrogen metabolism in the adult body may differ in some respects from that observed during the growth of the young, or during the process of lactation.

The subject experimented on was a healthy young woman and partly the Steck and partly the Thomas methods were used. A double series of experiments was carried out on the metabolism of nitrogen from wheat gluten and almond meal (the latter prepared by chopping blanched almonds very fine, sifting them, and washing five or six times with ether). The experimental period lasted about 6 months; the results are shown in detailed tables, and summarised as follows: —

The "biological values" of wheat gluten and almond meal, determined by the usual minimum nitrogen feeding method and calculated according to the formulas proposed by Thomas, are found to average 70.5 and 94.0. This figure for wheat gluten is nearly twice that found by THOMAS, using wheat flour.

When as much as 0.102 gm. of gluten per kg. of body weight was fed, a positive nitrogen balance was obtained, but when the intake fell to 0.07 gm. per kg. the positive balance was not maintained, and at 0.068 gm. per kg. became negative.

A satisfactory positive nitrogen balance was not obtained with the largest amount of almond meal used, 0.071 gm. per kg. of body weight.

The character of the basal low protein diet used affected the apparent availability of these protein foods, as expressed in terms of the THOMAS formulas for biological values.

1069 - **The Dietary Properties of the Pea.** — MC COLLUM, H. V., SAMMONS, N. and PARSONS, H. T. (John Hopkins University, Baltimore), in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 2, pp. 287-301, 8 charts, bibliogr. of 18 works. Baltimore, February, 1919.

For several years the authors have been engaged in the study of the special dietary properties of human foodstuffs, with a view to discovering the exact nature of their deficiencies from the dietary standpoint. These studies have now included all the more important cereal grains, wheat germ, the navy bean, certain leaves, mixtures of cereal grains and leguminous seeds, and complex mixtures of seeds including both the cereal grains and leguminous seeds, especially the pea and bean. The results of these studies have led the authors to formulate a new classification of the food stuffs based on their biological functions. Among the vegetable foods, those which are functionally storage tissues, such as seeds, tubers, certain roots, and to some extent certain modified leaves, e. g. the thick leaf of the cabbage, show decidedly greater dietary deficiencies than ~~the~~ those which are the seat of great metabolic activity. Examples of the latter class are leaves in general, but more especially the thin leaves which are not filled with reserve food materials, the germ of the seed, and probably also those parts of tubers and fleshy roots which are rich in cellular elements. The seed, tuber and root group are all decidedly deficient in calcium, sodium, and chlorine among the inorganic elements, and in the quality of their proteins, and, with few exceptions, in the content of fat-soluble A. The leafy portion of the plants approximate complete foods, and in some plants are actually complete foods which suffice to maintain a state of good nutrition in animals for years.

The work in question describes work on the dietary properties of the common pea, which supports the general theory that vegetable foods with similar functions have likewise similar dietary properties. It also gives records of experiments which show the supplementary relationships between the proteins of the pea and casein, gelatin, zein, and lactalbumin respectively. It is of interest to note that, while both casein and zein supplement the deficiencies of the pea proteins, gelatin and lactalbumin do not. From the failure of lactalbumin to supplement the proteins of the pea, or to induce growth when fed in the amounts used in the experiments of the writers, they have come to the tentative conclusion that lactalbumin is either an incomplete protein or a poorly constituted one. If lactalbumin were a good protein, the 9 % used to make up a content of 10 % of pea protein should itself have been sufficient to induce good growth. In another work, the writers have shown that 8 % of protein derived from the mixture of proteins contained in milk is sufficient to lead to nearly normal growth, and 9 % of a protein mixture, two-thirds of which is derived from rye and the remainder from linseed cake, is of such good quality that with this amount in the diet young rats grow at the optimum rate to full adult size.

No growth was obtained in young rats with diets containing 18 % of lactalbumin as the sole source of protein, when the remainder of the

food mixture was so constituted that good growth could be secured when the protein (18 per cent.) of the diet was casein. The authors were forced to the conclusion that lactalbumin is a poorly constituted or an incomplete protein, and that the excellent results of OSBORNE and MENDEL were due to the high proportion of nitrogen derived from "protein-free milk" which was present in their food mixtures and served to supplement the lactalbumin with respect to some as yet undetermined cleavage product which is essential for growth.

Zein is lacking in glycocoll and tryptophane and contains little, if any, lysine, and is very low in cystine, if indeed this amino-acid is present. Since the proteins of the pea are fairly well supplemented by zein, it follows that the limiting amino-acid in the pea is neither tryptophane, lysine, nor cystine. Glycocoll has been shown by MCCOLLUM and HOAGLAND to be readily synthesised by the mammalian organism.

1070 - **The Nutritive Value of the Banana** (1). — SUGIURA, K., and BENEDICT, S. R., in *The Journal of Biological Chemistry*, Vol. XXXVI, No. 1, pp. 171-189. Baltimore, Feb., 1918.

In many of the tropical countries the banana is one of the chief food-stuffs in the diet of the natives. Thus, ADAMS states that in the States of Parana and Santa Catarina, Brazil, the entire population subsists exclusively on bananas as a food, and coffee as a drink; and these sections are famous for the strength and endurance of their labouring classes. PRESCOTT points out that the combination of bananas and milk, in proper proportion, would constitute a good diet for man. MYERS and ROSE reported that the banana appears to be a particularly valuable food to employ in dietetic treatment in mild cases of nephritis with nitrogen retention.

The present work is a study of the nutritive value of bananas as determined by the maintenance and growth of albino rats when placed upon a diet of bananas, or bananas together with certain supplementary substances.

The results are shown in a number of tables and with eleven charts.

CONCLUSIONS. — 1) The banana is deficient in protein and water-soluble accessory as a foodstuff for the growth or maintenance of albino rats.

2) A diet of bananas, purified casein, and yeast or carrot-extract is sufficient for the perfect growth and reproduction of the albino rat. Such a diet is not, however, adequate for the production of proper milk by the mother.

3) Purified casein supplements the banana other than by the simple addition of protein. The casein in the ration cannot be satisfactorily replaced by washed and dialysed beef.

1071 - **The Antiscurbutic Property of Desiccated and Cooked Vegetables** (2). — GIVENS, M. H., and COHEN, B., (Sheffield Laboratory of Physiological Chemistry and Department of Public Health of the School of Medicine, Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXXVI, No. 1, pp. 127-145. Baltimore, Oct., 1918.

As the dried vegetable industry has extended until it is on a large scale, it is very important to ascertain what effect this treatment has from

(1) See R., Nov. 1918, No. 1198. (Ed.)

(2) See R., Jan. 1918, No. 2; Feb. 1918, No. 125; Dec. 1918, No. 1322. (Ed.)

the hygienic point of view on foods so treated. The writers studied the case of cabbage, a vegetable to which antiscorbutic properties have long been attributed, to determine whether drying at low temperatures (38-52° C.), high temperatures (65-78° C.) or cooking followed by drying at high temperatures destroyed these properties. In addition, they studied the physiological value of potatoes cooked and then dried at a high temperature (65-70° C.). Guinea pigs were used for the experiments.

It was found that a small daily addition of *raw cabbage* to a scurvy-producing diet was found to prevent scurvy in the guinea pig. Cabbage dried in a current of air at 40-52° C. retained some of its antiscorbutic value in that it would considerably delay the onset of scorbutic symptoms, thereby prolonging life. Furthermore, it could be employed as a dietotherapeutic agent if the signs of scurvy were recognised early enough. The course of the experiments led the writers to believe that the "low dried" cabbage will prevent scurvy in the guinea pig and initiate recovery from scorbutic symptoms, provided that the animal will consume a diet supplement of 1 gm. daily.

Cabbage heated in an oven for two hours at 75-80° C., then dried at 65-70° C. for several days, lost its antiscorbutic power. Cabbage cooked for 30 minutes, then subjected to drying for 2 days at 65-70° C. exhibited no potency as an antiscorbutic.

Potatoes cooked and dried for 2 days at 65-70° C., in the amounts used, possessed no antiscorbutic value. The experiments also indicated that roughage is not the determining factor in the course of scurvy in guinea pigs. They also confirmed the work of COHEN and MENDEL in indicating that the antiscorbutic property is not identical with the so-called fat- and water-soluble dietary at present recognised.

1072 - **The Antiscorbutic Factor in Lemon Juice** (1). — HARDEN, A., and ZILVA, S. L., in *The Biochemical Journal*, Vol. XII, No. 3, pp. 259-269, 5 diagr. Cambridge, Oct., 1918.

By eliminating the free citric and other organic acids in lemon juice by treatment with precipitated carbonate of calcium, addition of absolute alcohol, filtering and concentration, an antiscorbutically active residue is obtained. Comparative experiments by the writers showed that the best part if not the whole of the antiscorbutic content of the lemon juice is present in this fraction. After keeping the lemon juice for about a fortnight in cold storage, a marked loss can be observed in its potency although it still remains fairly active. By evaporating the treated lemon juice to dryness at 30-40° C. in acid medium an active dry residue is obtained. Subcutaneous injections of very potent doses of treated lemon juice (equal to 100 cc. of natural juice) failed to arrest the progress of well-declared scurvy in guinea pigs. The administration (by the mouth) of very concentrated doses of treated lemon juice, in quantity equal to 900-1280 cc. of natural juice, during 4 or 5 days and previous to depriving guinea pigs of the antiscorbutic factor, did not prevent or delay the onset of scurvy. The very high curative effect

(1) See *R.*, Jan. 1918, No. 2; Feb. 1918, No. 125; Dec. 1918, No. 1322. (*Ed.*)

of the treated lemon juice, administered by the mouth, on an advanced stage scorbutic monkey (*Macacus rhesus*) has been demonstrated. Hence the antiscorbutic principle of lemon juice should be administered by the mouth; it has a high curative effect but is of little value as a preventive.

1073 - **Wholesome Drinks Recommendable for Tropical Countries.** — See No. 1232 of this Review.

1074 - **The Reform of the Higher Agricultural Instruction Institutes and of the Agricultural Experiment Stations in Italy** (Atti del Comitato Nazionale Scientifico-tecnico per lo sviluppo e l'incremento dell'industria italiana). — *L'Industria*, No. 21, pp. 653-656. Milan, Nov. 15, 1918.

AGRICULTURAL
EDUCATION

Report of the Commission nominated by the Scientific and Technical Committee for the encouragement of Italian industries, instructed to report on the state of the Institutes in question and to bring forward propositions relative to the reform of the higher agricultural instruction Institutes and of the agricultural experiment stations in Italy.

I — **HIGHER SCHOOLS OF AGRICULTURE** — There are in Italy five higher schools of agriculture, of which three are under the control of the Ministry of Agriculture (Milan, Portici, Perugia) and the other two of the Ministry of Public Instruction (Pisa and Bologna).

The fact that the higher schools of agriculture are not all under the same direction gives rise to several inconveniences. First, the two groups of schools are differently organised, not merely in details but also in their general constitution. The instruction given is not in all respects the same, while the diplomas granted are so. This difference in teaching, as well as the lack of parallelism in the courses, makes the passage of pupils from one school to another difficult, a process which should be of real utility on account of the great diversity among Italian agricultural conditions. A fundamental and organic law is needed to co-ordinate instruction in agriculture.

Under present conditions the following reforms are considered necessary:

Apprenticeship on farms. — It is thought advisable for pupils leaving the schools to undergo a suitable practical course before taking up agriculture as a career. At present, some of the schools have no farm suitable for this purpose.

The students at the Milan school at present gain their experience at the peripatetic chairs of agriculture ("Cattedre ambulanti di agricoltura"). The holders of these professorships cannot, on account of their numerous activities, follow the course of each of their pupils, as would be desirable. It is therefore necessary for each school to have a farm of an industrial character, under separate management and financially self-supporting.

The teaching of agricultural industries must include good demonstration, beginning with the elaboration of agricultural products which the school farm could supply for such purposes. Likewise a trained staff is necessary which can devote its whole time to the study of these industries.

In some schools this teaching is carried out by class lecturers, without experimental material

Grants for museums and laboratories. — The sums granted by the authorities to the laboratories and scientific museums are not only too small but even below the minimum necessary. In certain cases the amount comes to only a few hundred francs per annum! The scientific apparatus is also too scanty, and the professors, being unable to meet teaching requirements and modern experimental necessities, find it impossible to carry out scientific research.

The remarks made regarding University laboratories, which are being now provided for, at least in part, apply equally to the laboratories in the higher schools of agriculture.

Experimental grounds, cattle sheds, etc. — It is no less necessary to found near the farm, but independent of it, and also in other places, well-equipped experimental grounds to put into practice the tests required for more advanced instruction and for progress in agriculture. The fields existing at present are entirely inadequate to meet these requirements, both on account of their limited extent and on account of the limited means at their disposal. It is likewise necessary to provide experimental stock sheds to allow for research, under conditions similar to those for practical work, as well as places for rearing silk-worms, poultry, etc.

Staff. — The organisation of the Milan and Portici higher schools of agriculture still remains as it was at their foundation. Thus the number of professors and assistants is unchanged, while the number of students has doubled and the length of the course has been increased to four years.

Reform of some of the chairs. — Some of the chairs are in need of reform, such as those of agricultural mechanics and of technology of agricultural chemical industries in the Milan school, the latter subject having as yet no professorship attached to it.

Regarding agricultural mechanics, the professor must be in a position to make studies and trials of machinery, but for this purpose he must have one or more assistants as well as a workshop with technical specialists.

It is necessary also to improve the status of the assistants and increase the number of them, now quite insufficient, and in fairness the position of the junior technical staff should be defined and improved, as well as that of the administrative and working staff, all of which up to 1919 were unclassified and only in that year entered on the disablement and old-age insurance scheme (*Cassa per l'invalidità e la vecchiaia*).

All these basic defects can be remedied only by a law to co-ordinate, modify and complete the existing system. In passing it may be remarked that a special law and regulation has already been provided for the higher schools of commerce which were instituted at a more recent date than the schools of agriculture. The same is the case for the Florence royal institute of advanced forestry.

The annexed table shows the various items of expenditure, and the amount considered necessary to estimate in this connection:

COST OF EQUIPMENT: —

Farm (not including the land) of 100 to 200 hectares for two schools	600 000	lire
Experiment ground (for 4 teaching chairs) of 12 hectares, for two schools . .	200 000	"
Experiment stock-shed at 100 000 lire; for 2 schools	200 000	"
Silkworm nursery, places for poultry rearing, etc., 100 000 lire; for 2 schools .	200 000	"
Extension and organising of chairs of agric. mechanics and agric. chemical industries	200 000	"
<i>Total cost of equipment</i>	<i>1 400 000</i>	<i>lire</i>

INCREASE IN ANNUAL RUNNING EXPENSES: —

Experiment ground: 30 000 lire; for 2 schools	60 000	lire
Experiment stock-sheds, silk-worm rearing, etc., 20 000 lire; for 2 schools .	40 000	"
General grant for collections and laboratories, 10 000 lire; for 3 schools . .	300 000	"
Library, 10 000 lire; for 3 schools	30 000	"
8 professorships (increase from 4 500 to 7 000 lire); for 3 schools	60 000	"
Assistants for 3 schools	45 000	"
Farm managers, for 2 schools	14 000	"
Direction and technical staff and servants, for 2 schools	90 000	"
<i>Total increase in expenses</i>	<i>639 000</i>	<i>lire</i>
Royal Higher School of Agriculture Milan	239 401	lire
" " " " " Portici	234 695	"
" " Institute " Perugia	165 204	"
<i>Total annual running expenses</i>	<i>639 300</i>	<i>lire</i>

II. AGRICULTURAL EXPERIMENT STATIONS. — In Italy the first agricultural experiment stations were founded in 1870-1871-1872. Some of them were of the general research type, others (Padua, Lodi, etc.) specialised. Later on, other stations were founded and some were discontinued. Their programmes were good, but for want of sufficient support they found it difficult to exist.

The agricultural experiment stations must be rescued from the almost abandoned state into which they have fallen, so as to permit the carrying out of the programmes for which they were founded. As it was a royal decree which called them into being, like the higher schools of agriculture, therefore a law is needed to provide for their systematic reorganisation so that they can be in a position to take up agricultural experiment with appropriate and sufficient means. The means at present available to them and their present organisation could not support really effective work.

Since being first founded, the agricultural experiment stations have been charged with the service of analysing agricultural materials for public and private institutions. As the number of analyses went on increasing enormously, this led to the abandoning almost entirely of experimental work. The work of analysis, as well as the survey and enforcing of State laws (with regard to oils, wine, butter, cheese, fertilisers, etc.) must not be allowed to supplant and crush out experimental work, as often happens.

The analytical department should be apart from the others, or handed over to a special institute organised by the government with suitable means and staff.

The discontinuance and the transformation of some agricultural experiment stations into badly equipped laboratories of agricultural chemistry (Udine, Forlì, Palermo) is in reality a step backwards. These laboratories being unable to be of real utility in scientific research, should be done away with, or should be returned to the old form, with the real functions of agricultural stations.

Of late years, new stations have been created which meet present requirements rather better, such as the seed-growing station at Rieti, the beet-growing station at Rovigo, the citrus-growing station at Acireale, the rice-growing station at Vercelli and the agricultural bacteriology station at Crema.

It should not be forgotten, also, that the regulations in force for Italian agricultural stations vary from one institute to another. Some stations founded by consortia of several institutions with the help of the Ministry, enjoy a certain amount of autonomy, which is not always of advantage to the purposes for which the stations were founded.

The conditions for the staff of stations, who are in charge of fine work, ought to be improved, if it is to become possible to recruit them and to retain them for any length of time.

All the agricultural experiment stations should, in addition, have adequate grants to buy laboratory supplies if they are to do useful work, whereas at present they get only trifling sums (sometimes insufficient, or almost so, to pay the salaries of the staff), and they should also have a farm or experimental grounds adapted to the necessary investigations. Again, the stations which are of a specialised type should be provided with the means necessary to practice the industries which constitute their programme of work. Likewise, the stations for cheese-making, wine research, etc., ought to own special holdings, machinery for the treatment of milk, cellars for wine making, etc. and under conditions similar to those obtaining in private industries.

Need is felt also for some new special stations, which would be of great interest now, as for example, an agricultural-mechanics station.

There are regions which have no agricultural experiment institution, such as Sardinia and the whole of South Italy, where there is only one station of a special nature, itself in process of reorganisation (Acireale). Hence the existing institutes should be distributed in a suitable fashion, so that local conditions may be studied on the spot.

During the session 1914-15, the sum of 328 910 lire was spent in Italy for 12 agricultural experiment and special stations, or an average of 31 900 lire per station. In addition, the Ministry contributed a total grant of 146 100 lire to 24 independent experimental institutions annexed to schools and to various other bodies. Hence, in 1914-15, the sum of 500 000 lire was spent in Italy on agricultural experimentation.

In order to satisfy the urgent requirements shown in the domain of

Italian agricultural experiment, a complex collaboration would seem to be necessary. It is for the Government to take the opportune legislative steps and to make grants, supplemented by contributions from local bodies and agricultural societies. The help also of manufacturers who are engaged in working up the raw material of agriculture, and of all those who have a direct interest in agricultural production or progress, is necessary. The possibility of direct help from farmers, especially great landowners, should not be overlooked either.

The financial statement which follows, based on the preceding remarks, includes the reorganisation of extant experiment institutions and the foundation of 5 new agricultural stations for which the need is much felt.

(A) REORGANISATION OF EXISTING INSTITUTES.

(1) Royal agricultural experiment stations, of general character (Turin, Asti, Lodi, Padua, Rovigo, Modena, Florence, Rome [2], Rieti, Ascoli Piceno, Acireale).

(2) Various agricultural experiment institutes (Agricultural chemistry laboratory and experiment station of the Royal Higher School of Agriculture Milan — Rice-growing station of Vercelli — Agricultural chemistry laboratory of Udine — Agricultural chemistry laboratory of Forlì — Agricultural bacteriology experiment station of Crema).

(B) PROPOSED NEW EXPERIMENT INSTITUTES.

2 for South Italy, 1 for Sicily, 1 for Sardinia, and 1 Institute of agricultural mechanics. In all, 5 institutes.

COST OF EQUIPMENT (buildings excluded) :

Equipment of experiment grounds or industrial plant, etc. : 22 institutes at 50 000 lire each	lire 1 100 000
Extra grants to existing institutes for increase and improvement of scientific and other equipment : 17 institutes at 20 000 lire	340 000
Scientific and other material for equipping 5 new institutes, at 100 000 lire each	500 000
<i>Total cost of equipment</i>	<i>1 940 000</i>

INCREASE IN ANNUAL RUNNING COSTS.

For the 12 institutes enumerated in (1) above at 60 000 each	720 000
For the 5 institutes (with smaller grants at present) enumerated in (2) above, at 100 000 lire each	450 000
Annual cost of 5 newly established stations, at 100 000 each	500 000
<i>Total increase per annum</i>	<i>1 670 000</i>

ANNUAL EXPENSES (session 1914-15).

	lire
For agricultural experiment stations and institutes	529 000

1075 - **Creation of a Forestry School at Madagascar and Exploitation of the Forests by the Public Administration.** — *Bulletin de l'Office colonial*, Year XII, No. 137, pp. 350-351. Paris-Melun, May, 1919.

By the decree of March 14, 1919, the Governor General of Madagascar set up a native school of forestry at Analamazaotra, near Périnet, on the railway from Tananarive to Tamatave.

As stated in the preface which precedes the decree, the intention is to safeguard the island forest, which was threatened by the depredations committed by the natives on their own account or on behalf of certain European exploiters. The native pupils will learn at this school conditions of management, working and renewing of the forest. To make the teaching of practical value, a forest reserve of over 100 000 hectares is attached to the school. This area will also enable the colony to supply firewood for the railway from Tananarive to the east coast and industrial timber for the other public services.

The European and native staff of directors and overseers will share in the profits of the undertaking, as well as specially deserving workmen who have worked steadily. The share of the staff is fixed at 10 % of the profits realised by the colony on the undertaking.

Several forest sections have been made into reserves and will be developed under the public administration.

As cutting goes on, regeneration of the forest will be undertaken.

The opening work on the Analamazaotra scheme was begun in the presence of M. FAUCHÈRE, Inspector General of the Agricultural and Forest Departments.

1076 - **A Timber Institute for the British Empire.** — UNWIN, A. H. (Late Nigerian Forest Service), in *United Empire*, Vol. IX (New Series), No. 16, pp. 285-287. London, 1918.

Prior to the War, the chief West African timbers which found a ready market in England were obtained from the following species of trees: - Mahogany and various *Khaya* and *Entandrophragma* species; cedar mahogany and cedar (*Guarea* sp.); African walnut (*Lovoa Klaineana*); ebony (*Diospyros* sp.); iroko (*Chlorophora excelsa*). Other species reported on favourably were red ironwood (*Lophira procera*); oak (*Ostrya derris*); mahogany (*Azela africana* and other species); satinwood (*Alseodendron luxiflora* and *Zandoxylon macrophyllum*); red oak (*Berlinia* sp.); mahogany (*Ricinus dendron africanum*); cedar mahogany (*Carapa* sp.). In the West African forests, however, there are several hundred different species and genera of timber trees.

On the other hand, although the Germans started several years later in testing similar timbers obtained from the Cameroon and Gaboon, they had succeeded, prior to the out-break of the War, in finding a good market in Germany not only for ordinary African mahogany, but also for the heavier varieties, as well as for other promising hardwoods, such as paddlewood (*Uvaria Busgenii*) and, most important of all, several kinds of soft woods, such as cotton tree (*Eriodendron orientale*).

At the present (1918), of course, all imports into England are stopped,

and thus the timber export trade from British West Africa is more or less at a standstill. However, that need not preclude from considering what type of business organisation or institute is necessary in order to promote the most rapid, efficient, and full use of all the available timbers in British West Africa for the British market.

Already in England there is the Imperial Institute, created especially for examining and reporting on the suitability and value of colonial products generally. While using the facilities thus offered to the fullest extent, it seems most necessary to form a Bureau or Institute subsidiary or allied to the Imperial Institute, charged primarily with the function of enlarging, developing, and finding new markets in Great Britain for West African timbers after they have been technically examined as to their value.

The main functions for this Institute would be : —

- 1) The receiving of timber samples, first, perhaps, from British West Africa, but later on from all other British Colonies, through the good offices of the Colonial Office and Colonial timber merchants, and lastly from the rest of the world.
- 2) Obtaining research reports as to the latest methods of timber investigation from the Department of Scientific and Industrial Research.
- 3) Obtaining technical reports as to qualities, etc., from the Imperial Institute or other sources.
- 4) Obtaining lists of any new timber-using trades or industries from the Commercial Intelligence Branch of the Board of Trade.
- 5) Circularising members of the Timber Trades Federation as to new timber and obtaining from them names of new members.
- 6) Notifying the Worshipful Company of Carpenters of all new timbers, and getting papers read before them on these subjects.
- 7) Obtaining reports as to values from brokers and merchants, after those mentioned in (3) have been submitted to them.
- 8) Circularising all timber merchants and users, as to new timbers received and likely to be of use to them.
- 9) Notifying the Wood-workers Society or other trade unions of wood-workers, such as the Amalgamated Society of Joiners and Carpenters, of any new timbers introduced, inviting their cooperation in their extended use in the suggested industries.
- 10) Putting colonial exporters or importers of timber in touch with home brokers, merchants and users of new colonial timbers.
- 11) Stimulating, both by pamphlet writing and advertisement in the Press, the use of new colonial timbers.
- 12) Forming an impartial, business-like scientific platform for the consideration of all matters connected with wood.

CROPS AND CULTIVATION.

1077 - Effects of Climatic Conditions on Wheat Development at Tapada de Ajuda, Portugal. - FIGUEIREDO, E. B. A., in *Jornal de Sciencias mathematicas, fisicas e naturais*, Vol. II, No. 5, pp. 29-32, 2 plates. Lisbon, January, 1919.

Results of a series of parallel experiments on wheat development and climatic conditions made with the view of determining in what manner, and to what extent, these conditions influence the growth of the seed and the quantity and quality of the crop.

For this purpose, two sowings were made during the agricultural year 1916-1917, one (A) on November 1, the other (B) on January 8; owing to the different dates of these sowings, the growth, stages of the plants coincided with different dates and different conditions of weather, thus making it easy to discover any possible bio-meteorological correlations.

In the case of both of the above-mentioned crops, the following stages were taken into account: sowing, germination, tillering, ear-formation, ripening, harvesting, observations being made at the same time upon the temperature of the air, the number of hours of sunshine, the amount of the rainfall, and the dampness of the soil at a depth of 30 cm.

It is shown by the data collected, that the action of rain, especially of that falling between the tillering stage and ear-formation, is the dominant factor. Its action, contrary to what occurs in other countries, is negative; the less rain, the larger the crops. Excessive humidity at the tillering stages completely saturates the ground producing the rotting of the old roots, which prevents the growth of young roots exactly at the time when the plant has the greatest need of a well-developed root system in order to cope with rapid and extensive growth. Hence the inverse relation between rainfall and grain yield.

TABLE I. — *Data obtained for year 1916-1917.*

	Sowing A	Sowing B
Yield	3.9 times the seed corn	13.3 times the seed corn
Weight of 1 litre of wheat.	0.75 kg.	0.80 kg.
Rainfall in mm. { From sowing to germination	90.6	127.2
" germination to tillering	90.2	74.3
" tillering to ear-formation	574.8	70.3
" ear-formation to harvest	83.2	71.6
Totals	838.8	343.9

By adding to the data of 1916-1917 those referring to the 3 preceding years, a total of 8 experiments is obtained, of which the results fall under two heads: 1) scanty yield; 2) heavy yield.

Table II gives the average data of the 2 lots.

TABLE II. — *Average Data for the 2 lots.*

	Scanty Yield	Heavy Yield
Yield	7.5 times the seed corn	13.7 times the seed corn
Weight of 1 litre of corn	0.781 kg.	0.80 kg.
Rainfall in mm. { From sowing till germination	60.7	84.3
" germination till tillering	159.7	183.4
" tillering till ear-formation	532.4	325.0
" ear-formation till harvest	76.4	68.5
Totals	829.2	661.2

These data confirm what was said respecting the year 1916-1917, and also prove that at Tapada de Adjuda (Portugal), there is an inverse relation between the yield of grain and the rainfall at the tillering period.

1078 - **The Effect of Climatic Conditions on the Vegetative Growth and Seed Production of Rice in the Philippines.** — DE PERALTA Y LEANO, F., in the *Philippine Agriculturist*, Vol. VII, No. 6, p. 159-183, Los Baños, January, 1919.

The results of parallel experiments planned to bring out the correlations between the development of rice (Inintiw variety) and climatic conditions. The work was done by the author, at the Agricultural College of Los Baños (Philippines). In the biometric tables, the following details are taken into account: length of vegetative period; growth in leaf area; height of stalks; time of ripening; yield of grain. The weather records included the air temperature in degrees C.; rainfall in cc.; evaporation in cc.; insolation in cc. The evaporation was measured with a Livingston atmometer with porous cups.

The data thus obtained are collected in tables and also plotted as graphs.

Growth in Leaf Area. — We find from examining the diagrams giving the amount of insolation and evaporation, that the leaf product increases with the increase in insolation and evaporation. Thus, in lot I, the leaf area is 5072.6 sq. cm. and the evaporation 4016.7 cc.; in lot II, the leaf area is 2589.5 sq. cm. and the evaporation 3161.9 cc.; in lot III, the leaf area is 2111.8 sq. cm. and the evaporation 2785.6 cc., and so on. The effect of temperature is much less noticeable than that of evaporation, but during the cooler periods the leaf-product is less than during periods of ordinary temperature.

Straw. — In the case of the straw, as in that of the leaves, the highest yield is obtained when evaporation is greatest. The corresponding values were: in lot I, straw 5223.3 gm. total evaporation 4016 cc, and in lot 8, straw 1305.9 gm., total evaporation 1799.2 cc.

Grain. — The grain yield rises with the increase in evaporation. The total evaporation was 2161.9 cc, and 1799.2 cc. when the yields were 74.4 cavanese (I) and 9.2 cavanese respectively.

On the other hand, there appeared to be no connection between rainfall and grain yield.

Conclusion. — Evaporation would appear to be the factor chiefly affecting the growth and yield of the Inintiw variety of rice.

1079 - **The Effect of Climatic Conditions on the Formation of Cyanogenetic Glucosides in Sorghum.** — See No. 1104 of this Review

1080 - **The Effect of Winds on Tobacco Plants in Java.** — See No. 1126 of this Review.

1081 - **Effect of Rainfall Upon the Development of Annual Rings of Wood.** — AZZI, G. *Bollettino bimensuale della Società meteorologica italiana*, Year 1917, Nos. 10-11-12, pp. 1-7. Turin, 1919.

The results of a series of experiments made by the writer at the Botanical Institute of the Royal University of Rome, for the purpose of discovering

(1) 1 cavana = 75.065 litres. (Ed.)

whether any correlation exists between the rainfall and the development of annual rings in the wood of the vine (*Vitis vinifera*), the mulberry (*Morus alba*), and the oak (*Quercus* sp.)

The thickness of the rings was measured with an ordinary micrometer eye-piece, and for each ring, the average of 10 estimates made in 10 different radial directions was taken.

The meteorological data as well as drawings of the sections examined were obtained from the Modena meteorological year book.

In order to calculate the possible correlation exactly, Yule's formula was used, the biometric data, and the meteorological data being taken as factors. The formula is as follows:—

$$r \text{ (co-efficient of correlation)} = \frac{\Sigma \sigma p \sigma s}{\sqrt{\Sigma \sigma p^2 \times \Sigma \sigma s^2}}, \text{ or}$$

σp = the deviation from the average decennial April-July rainfall at Modena during the period 1905-1914.

σs = the deviation from the average thickness of the rings during the same period.

In applying this formula, the values obtained for r were those included between + 1 (perfect positive correlation) and — 1 (perfect negative correlation): figures above + 0.5 and — 0.5 thus denote a high degree of correlation.

The appended Table gives the data for the vine

Thickness of Annual Rings in the Vine and the total April-July Rainfall for the Decennial Period 1905-1914

I	II	III	IV	V	VI	VII	(3 × 6) VIII
1905	394	151	22 801	100	29	841	4 379
1906	323	80	6 400	130	59	3 481	4 720
1907	202	41	1 681	78	7	49	287
1908	141	102	10 404	30	41	1 681	4 182
1909	114	129	16 641	36	35	1 225	4 515
1910	212	31	961	70	1	1	31
1911	295	52	2 704	55	16	259	832
1912	201	42	1 764	75	4	16	108
1913	225	18	324	74	3	9	54
1914	326	83	6 889	65	6	36	498
	243		68 569	71		7 598	15 998

From left to right this table shows:—

Column I : Year

II : Total April-July rainfall.

III : Deviation from the decennial average = σp .

IV : Square of this deviation = σp^2 .

V : Thickness of annual ring expressed by the number of the divisions of the micrometer scale.

Column VI : Deviation from average thickness = σs .

• VII : Square of this difference = σs^2 .

• VIII : The values given in this column are obtained by multiplying the 2 deviation figures, $\sigma s \times \sigma p$.

Let us now apply the formula. The algebraic sum of the products of the differences ($\Sigma \sigma p \sigma s$) equals 15 998. The product of the sums of the squares of the differences ($\Sigma \sigma p^2 \times \Sigma \sigma s^2$) equals 520 987 262 ($= 68 569 \times 7 598$): extracting the square root, we obtain 22 825.

Dividing 15 998 by 22 825, we obtain for r the value of $+ 0.70$, which shows a very high degree of correlation. The maximum value of r corresponds to the April-July rainfall; for the longer, or shorter, rainy periods r diminishes.

In the case of the mulberry, the maximum value of r ($+ 0.70$) corresponds to the period of the 4 months May-August: on the other hand, in that of the oak, $r = + 0.4$ corresponds to the three months May-July. The more developed the foliage, the more efficacious is the action of the rain, and if the different growth periods of the trees in question occur at different times, the periods during which r attains its maximum value are naturally also different.

In his *general conclusions*, the author, after having insisted upon the importance of the positive results obtained, predicts the possibility of discovering, by means of further experiments, the bio-metereological laws, which would perhaps allow us to find in sections of very old trees, and also in fossil tree trunks, approximately accurate records of the weather conditions in far-off times, and in countries concerning which no meteorological data exist.

1082 - **Protection against Hail.** — L. ABERGERIE, in *Revue de Viticulture*, Year XXVI, Vol. LI, No. 1308, pp. 53-57. Paris, July 24, 1919.

In this article, the author gives a summary of facts relating to the storms that have occurred during the last few years in different parts of the country, and the damage they have caused. He treats successively of the effect of hail-rods (*niagaras électriques*), and anti-hail cannons, bombs and rockets. He concludes from the results of the experiments carried out, that there is no practical manner of controlling hail, and states that the great expense which has been incurred in the attempt to devise apparatus for this purpose, has produced no adequate results; hence, all further efforts in this direction are useless.

1083 - **The Lateritic Soils of British India.** — CLOUSTON, D. and PADMANABHA Aiyer, A. R., in *The Agricultural Journal of India, Special Indian Science Congress Number*, 1918, pp. 89-91. 7 figs. Pusa.

SOIL PHYSICS,
CHEMISTRY
AND
MICROBIOLOGY

In the Central Provinces of British India, there are vast areas of lateritic soil, of which the greater part is uncultivated, because no crops can be successfully grown there, unless the methods adopted answer to the requirements of this special type of soil. Here and there "kodo"

(1) See. R., December, 1918, No. 1362. (Ed.)

(*Paspalum scrobiculatum*), a forage plant of little value, is, however, cultivated. The ground fetches from 3 to 3.8 rupees per acre. The lateritic soil contains 69 % of gravel and stones, and 31 % of fine material, as against 4 % and 96 % of gravel and fine material respectively for black cotton soil.

In comparison with soils containing much fine material, lateritic soils are poorer in nitrogen, phosphoric acid and lime. Although they have long remained uncropped, they are well supplied with micro-organisms, their ammonifying power is good, and their nitrifying capacity fairly good, but it is inferior to that of the black soils of the cotton plantations. As lateritic soils are well-aerated and porous, it is only necessary to irrigate and manure them sufficiently, in order to obtain splendid crops. This has been satisfactorily proved at the Government Farm at Chandkhuri (United Provinces), which is situated on lateritic soil, and where 40 tons of stripped sugar-cane, 2 400 lb. ground-nuts, and 180 lb. unginned cotton have been obtained per acre.

India possesses many millions of acres of waste land of lateritic soil, which by means of irrigation, might become garden land of the best quality.

1084 - **The Effect of Organic Matter on Soil Reaction.** - STEPHENSON, R. F. (Iowa Agricultural Experimental Station), in *Soil Science*, Vol. VI, No. 6, pp 413-439, bibliography of 22 publications. Baltimore, 1918.

The object of this work was to study the effect of decomposing organic matter upon the production of acids or bases in the soil. Very little has hitherto been done in this direction, hence the special importance of the present investigations. Pots containing two soils were used in these experiments, one a dark soil fairly rich in organic matter, the other a sandy loam poor in organic matter. To these soils were added albumin, casein, starch, dextrose, lucerne and ammonium sulphate. In one series of pots, the soil was limed, on the other it was not. Optimum moisture conditions were provided as nearly as possible by daily watering, but no plants were grown in the pots.

Results. - None of the organic substances added increased the lime requirements of the soil; the highly nitrogenous materials had rather the effect of decreasing the acidity. The carbohydrate materials had a small and inconstant effect upon the soil reaction, whereas ammonium sulphate consistently caused a marked increase in the lime requirement of both soils. The nitrogenous organic materials, which tended to protect the carbonates of the soil at first, later on, used up the limestone. Ammonification was greater on the unlined pots of both series; the sandy loams were acid soils. A difference in the soil flora may possibly explain this increased ammonification. Both the casein and blood ammonified more rapidly than the dried blood. Ammonia did not accumulate in the presence of either carbohydrates or lucerne.

Finally, in the presence of carbohydrates and of lucerne, no nitrates were found until the end of the 15th. week; this was probably due to their having been consumed by the organisms of the soil.

The two soils used in the experiment showed marked differences in their behaviour under the different treatments. The more acid soil was the more active, probably because of a greater content of organic matter and a more abundant microbic flora. This shows that measurable acidity is not an index of toxicity. The permanent effects of acidity are attributable solely to the liberation of mineral acids, but the basicity resulting from the breaking down of protein is of a more lasting character than any acidity that may result. This is due to the fact that the organic acids are either volatile, or are oxidised to carbon dioxide which is volatile, whereas nitrogenous bases are continuously active, and are held by the soil until they are nitrified.

Conclusion. — It may be stated that, in general, the organic matter in the soil seems to act the part of a base rather than that of an acid, at least to the extent that a given acidity is less detrimental in the presence of an adequate supply of organic materials.

1085 - The Relation of the Lime Requirements of Soils to their Retention of Ammonia.

— HOWARD, L. P. (Rhode Island Experiment Station), in *Soil Science*, Vol. VI, No. 6, pp. 405-411, bibliography of 3 publications. Baltimore, 1918.

The author suggests the following new method for determining the lime requirement of a soil: 25 gm. of soil in an evaporating dish are treated with 50 cc. of N/5 ammonia, the mixture being stirred occasionally during a period of one hour. Then the solution is evaporated to dryness on a water-bath, and the soil is crushed with a pestle, and allowed to remain on the water-bath for 1 ½ hours. After this, the soil is washed into a Kjeldahl flask with 100 cc. of ammonia-free water, 5 to 10 gm. of sodium carbonate is added, and the ammonia is determined by the aeration method. Blank determinations should be made with each soil. The results thus obtained are sufficiently independent of the concentration of ammonia added, the time of contact, and the temperature during evaporation. The lime requirement, as calculated by the writer, was about 25 per cent. lower than that indicated by the classical Veitch method.

Sodium, ammonium and potassium are absorbed from solutions of their hydroxides and carbonates by the soil, and are retained in practically equal amounts. The writer believes that the ammonia retained is held chemically by a neutralisation of free acids, acid organic compounds, or acid salts, while physical absorption is largely prevented. The lime requirement based upon the ammonia retention agrees, in general, with field observations, for the soils that were proved by this method to need lime most were those that were actually most deficient in this substance.

1086 - The Harmful Action of the Salts of Sodium and Potassium upon Soil Structure.

— HAGER, G. (Mittellung der Lanv. Versuchstation Kempenkhein), in *Journal für Landwirtschaft*, Vol. LXVI, Part. 4, pp. 241-286, 1 fig. Berlin, 1918 (1919).

Although many experiments have been made in order to determine the effect of different fertilisers in increasing the yield of various agricultural crops, little, or no, attention has been paid to the action of salts upon the physical properties of the soil. This is, however, a very important matter ;

crude potassium salts, for instance, have a very injurious action upon compact soils.

A large series of experiments was carried out by the writer, who let saline solutions flow through soils, possessing the property of transposing bases. The saline solution was then washed out of the soil, and the physical changes it had produced in the latter were noted.

It was found that the power the soil has of transposing bases depends upon the presence of weak acids. The compounds of the latter undergo hydrolysis, which frees the combined bases. If the base is bivalent, the action upon the soil is a favourable one, but if it is monovalent, its effect, on the contrary, is injurious. The hydrolysis of the compounds of weak acids is prevented by the presence of dissociated salts having the same cation, and yet, when alkaline salts are present in the soil solution, there is no liberation of alkaline hydroxides; and consequently, no deterioration of the soil.

This explains why the soil of land inundated by the sea does not suffer, until the sodium chloride is washed out, when the hydrolysis of the soil zeolites begins, and alkaline hydroxides commence to make their appearance in the soil solution. The latter substances give rise to the formation of a thick mud, the soil particles making a compact mass instead of a granular aggregation, as they do when associated with calcium compounds. As regards their action in this respect, sodium salts are even more harmful than those of potassium. The action of the salts of sodium, as well as that exercised by the alkaline hydrate on all the soil constituents, humus and clay alike, is the more injurious, because it causes a great disintegration of the humus, which has considerable protective properties.

1087 - **Can the Probable Fertility of a Soil be Predicted from Biological Data?** — BURGESS, P. S. (Experiment Station of Hawaiian Sugar Planters' Association, Honolulu), in *Soil Science*, Vol. VI, No. 6, pp. 449-462. bibliography of 24 publications. Baltimore, 1918.

Experiments carried out with 9 Hawaiian soils with a view to the correlation of their fertility, or rather, their crop-producing powers from the following microbiological data: ammonification, nitrification, and organic nitrogen fixation. These data were checked by comparative tests.

Ammonification tests are not suitable for differentiating between the fertilities of average soil, although they will often show differences between very poor and very good soils. In the same way, the crop-producing power of a soil in no wise depends upon its capacity of dissolving organic nitrogen.

On the other hand, nitrification (soil culture method) is by far the most accurate biological test for estimating soils fertility. It must not be forgotten, however, that though nitrification tests may be a means of differentiating between good and poor soils, they do not show the causes of the differences noted, nor the way in which the condition of the infertile soil can be improved. Only chemical, physical and physiological experiments can give us this information.

A remarkable correlation was found between the amounts of nitrogen fixed in mannite solution cultures and the known fertilities of the soils studied. These data afford a means of estimating the fertility of a soil from the standpoint of its power of nitrification; naturally, the fixation of the nitrogen depends largely upon the presence of species of *Azotobacter*.

1088 — **The Agricultural and Forestry Problem of the Steppes of Tripolitania.** — BOKZI, A., in *Bollettino di Studi ed informazioni del R. Giardino Coloniale di Palermo*, Vol. V, Parts 1-2, pp. 76-87. Palermo, 1919.

OPENING-UP
LAND FOR
CULTIVATION

The Libyan steppe is characterised by extreme aridity, the frequency and violence of the winds, and the scarcity of fertilising substances in the soil. In order to turn it to account, it would therefore be necessary to grow crops that could adapt themselves to the conditions obtaining there, and which, at the same time, permit of intensive cultivation. Some of the succulent plants fulfil both these requirements; amongst them are: the Barbary fig, agaves, *Fourcraea*, etc., which supply fruit, textile fibres, fodder, and raw materials for the manufacture of cellulose.

The plantations of *Agave sisalana* on the railway embankments have been entirely successful. The following woody plants, or shrubs (even the latter are of value, in a country so poor in wood), may be mentioned: 1) native species: — *Zizyphus Lotus*, *Rhamnus olcoides*, *Lybium europaeum*, *Juniperus macrocarpa*, *J. phoenicea*, *Tamarix articulata*, *Capparis Sodada*, etc.; 2) species to be introduced and capable of acclimatisation: — the different species of *Tamarix*, *Rhus pendula*, *Ephedra* sp., some species of *Elaeagnus*, *Schinus molle*, gum and tannin acacias, and a few others. For binding the soil the following plants may be used: several *Graminae*, *Genista* (which also enriches the ground), lucerne and esparto grass (the latter supplies a textile material), etc.

1089 — **The Infiltration of Water in Agricultural Soils.** — HUGUES, C., in *Il Villaggio*, April 26, 1919, reprinted in *Il Giornale di Riscoltura*, Year-IX, No. 5, pp. 74-78. Vercelli, May 31, 1919.

PERMANENT
IMPROVEMENTS
DRAINAGE AND
IRRIGATION

The experiments made by MÜNTZ on the relation between the volume of irrigation water, and the infiltration capacity of the soil have proved that the unit volume of 1 litre, or 1.20 litres per second and per hectare, hitherto accepted by hydrologists, must vary according to the precise determination of the infiltration capacity of each irrigated soil, which fact will permit of greater economy in the use of water in irrigation.

The rapidity with which water penetrates and descends in agricultural soils, is of paramount practical importance, both to ordinary and irrigated crops, though perhaps the latter are the more affected by it. It is indeed not sufficient to use the necessary amount of water, it is also requisite that a large enough quantity of water succeeds in passing through the soil, and in reaching the required depth at the right time. This subterranean supply is not only required by the roots, which absorb it, and thus provide the water used in transpiration by the aerial organs of plants, but it also serves as a reserve in the deeper strata to replace the water that evaporates from the superficial layers.

Cultivation operations (hoeing, scarifying, weeding, etc.) are not only performed in order to reduce the capillarity of the soil, and thereby lessen the ascent of the water from the lower to the higher layers of the soil, but often with another and no less important aim, namely to facilitate the descent of the rain, or the irrigation water, to the roots, or to the water-reserves in the subsoil.

By "infiltration of water into the ground" is meant the more or less variable capacity of soils for allowing water to percolate more or less rapidly down from the surface to the more deeply-seated layers. In order to determine this property, laboratory research apparatus has been devised, which hitherto, however, have not given absolutely certain results that admit of being compared. The principle upon which these apparatus are constructed is to allow water to descend automatically from a Mariotte flask into a tube filled with the soil to be tested. This water then flows through a small tube, which passes through the hermetically-closed lower opening of the tube, into another Mariotte flask. The rapidity with which the water descends through a given distance of the column of soil in a tube of known diameter is measured. All the experimental conditions, such as the previous treatment of the soil sample, the amount of soil in the tube, etc., are maintained constant throughout.

The comparative examination, made by the help of this apparatus, of different samples of soil, shows at once that the smaller the volume of the soil particles, and consequently that of the capillary pore space, the more slowly does the water pursue its downward course. This depends as much upon the greater amount of capillary attraction acting in the opposite direction to the force of gravity, as upon surface tension which causes the formation of a water film around the soil particles. On the other hand, it is natural, that the degree of compactness of the soil in the tube influences the results of the test, and therefore should be constant for each series of experiments.

In the case of a clay soil with 42.83 % of pore space, all the other conditions of the experiment being constant, it took 113 hours and 42 minutes for the water to reach the lower opening of the tube, whereas the water percolated through a sample of alluvial soil with 57.36 % interstices in 96 hours and 18 minutes.

It should, however, be noted that as long as the soil in the tube is covered with water, the infiltration is invariable for all the different soil samples; variations only occur when all the layer of water has disappeared, and are due to the descent of the water by absorption.

This factor is of special importance in the case of irrigation by means of a sheet of flowing water that covers the ground, such as is used in the "marcite", or where the water is kept at a given depth, as in rice fields, etc.

As has already been said, however, in addition to the factor of the volume of the interstices, there is also the surface tension of the particles which invests the latter with a film of water. Here, another element comes in, which depends upon the physical and chemical properties of the soil under examination.

In the case of two sandy soils, one containing 35.59 % of pore space, and the other 37.10 % the time required for infiltration was, respectively, 158 hrs. and 20 min., and 80 hrs. and 48 min. In sandy soils, the above mentioned inverse proportion between the small size of the interstices and the speed of the descent of the water is also noted.

Comparative experiments made respectively with pure water, an aqueous 1 % solution of sodium carbonate and a 25 % solution of sodium carbonate are interesting from a practical point of view. The pure water took 39 hours and 18 minutes to reach the bottom of the tube; whereas the 1 % and the 25 % solutions of sodium carbonate only required 32 hrs. and 45 min., and 28 hrs. respectively.

It must therefore be concluded that the rapidity of the descent in the soil increases with the concentration of the solution employed. This fact is of special interest as regards the diffusion of the top-dressings used on land which has been sown, and the rapidity of the descent of water-soluble fertilisers in general in manured fields.

GASPARIN stated that fairly heavy rain falling upon a dry, calcareous clay loam bare of vegetation, penetrates in 24 hours to an average depth of 6 times the mm. of rain-water that has fallen.

In 1883, from October 5 to November 5, the rain-gage of the Agricultural Institute and Experiment Station of Istria, at Gorizia, of which the writer was then Director, only registered 8.3 mm. of rain on October 22. After some drops of rain had fallen on the morning of November 5, an initial heavy fall of 23.5 mm. occurred, accompanied by the *ostro-scirocco* wind. After 24 hours, the investigations made by the writer, with the help of soil-borings, yielded the results given in the following table:—

Penetration of rain into "terra rossa" rich in oxides of iron and manganese.

	Penetration of rain downwards as a function of the amount of rain fallen	
<i>Unploughed Land:—</i>		
Centre of furrow with stubble.	350	14.8 times
Land unworked for 2 years.	355	15.1 »
Cart-road	280	11.9 »
Land unworked for 1 year	300-400	15.3-20 »
<i>Ploughed Land. —</i>		
Recent trenching to depth of 1 metre. . .	300	12.7 times
Ploughed to depth of 27 cm. and sub-soiled in August.	380	16.1 »
Ploughed to depth of 27 cm. in August without subsoiling.	350	14.8 »
Weed extirpator used in August	290	12.3 »
Scarifier used in August	330	14.0 »
<i>Cropped Land:—</i>		
Field of Sainfoin	170	7.2 times
Field of mowed Sainfoin	470	20.0 »
Field of Red Clover	250	10.6 »
Field of <i>Lolium italicum</i>	230	9.7 »
Field of <i>Lolium perenne</i>	210	8.9 »

The coefficient given by GASPARIN is not correct for the siderolitic *terra rossa* of Istria, for which the right figures are from 8.5 to 20 times the depth of water fallen. The cracks in uncultivated ground facilitate the passage of water, whereas a grassy or dusty surface retards its penetration. Very violent rain beating heavily upon the soil, renders the upper layer impervious. Generally, an initial gentle rain of 18 mm. is sufficient to visibly refresh and permanently benefit the parched vegetation the siderolitic *terre rosse* of the west coast of Istria. Heavier rain of shorter duration, with a minimum fall of 20 to 23 mm. in 2 or 3 hours, is sufficient to render the *terre rosse* impermeable and temporarily fill all the depressions with water. The heaviest rainfalls measured by the writer in 24 hours were: 72.6 mm. on July 2, 1885; 72 mm. on May 14, 1887; 59 mm. on June 17, 1884. In India, and Central America, sometimes a single shower affords 40 mm. of water, and as much as 500 mm. may fall in 24 hours of rain.

1090 **Irrigation in Peru.** — *The Tim's Engineering Supplement*, Year XIV, No. 530, p. 266 London, 1918.

In view of the materially improved financial condition of Peru, the authorities, both federal and municipal, find themselves in a position to carry into effect some of the several engineering undertakings that have long been under consideration. Among these is an irrigation and colonisation scheme, and in connection special irrigation laws have been passed.

Though the hydrographic systems of Peru do not — by reason of their uncertainty — lend themselves particularly favourably to great schemes of irrigation, there are few countries of South America more richly endowed with rivers. Some of them have their source in the streams upon the west of the Western Cordilleras, crossing transversely the strip of land between that Cordillera and the Pacific and emptying themselves into that ocean. Little or no attempt has been made to harness the numerous waterfalls that are encountered in various parts of the country, a fact that is largely explained by the majority of the streams, in the absence of any artificial restraint disappearing owing to filtration, or running only during the rainy season. Others dry up almost completely during the winter or are converted into brooks the water in which is supplied solely by the melting of the snows accumulated upon the summits of the Cordilleras. There is no doubt, however, that modern engineering could effect a great change in the adaptability of some of these Peruvian rivers, as has been done in similar cases in other parts of the American continent. The vast river system of the Amazon, among others, has yet to be exploited from this point of view.

Such irrigation as has hitherto been taken in hand has been confined almost entirely to the purposes of agriculture; in this there is nothing new, since the Incas have left evidence of a wide system of irrigation-canals designed for agricultural purposes, the ruins of which show that the original work of construction was of a solid character. In normal years, there are probably at least 30 000 000 000 cu. m. of water flowing in the coastal ri-

vers. This quantity, if the stream flow were properly regulated, would be sufficient to irrigate 15 000 square miles, or 60 per cent of the total estimated area of the coastal pampas and valleys. But it must not be assumed that this percentage of the total area is suitable for cultivation. Owing to the relation of the flood season to the period of growth of the most valuable crops, the utilisation of all the stream flow would require the storage of, probably, more than 15 000 000 000 cu. m., and it is quite possible that not more than 3 000 000 000 cu. m. could be stored owing to the conditions referred to.

The projects of the Peruvian Government comprise perennial, spring and summer irrigation, those likely to be first constructed being for spring or perennial irrigation. Among other proposals placed before the authorities is the scheme for the reconstruction of an old system which at present provides only summer irrigation, but which upon reconstruction could be made to furnish water to spring crops. This project is probably in many respects one of the most complex to be found in the Republic, requiring, in addition to the reconstruction of many miles of existing canal, the diversion of two rivers and the construction of a tunnel $2\frac{1}{2}$ miles long through the continental divide. The irrigation of 62 000 acres would be made possible by this project, and the entire cost is estimated at one and a half times the annual value of the cotton crop that could be grown upon the area benefited. Another project under investigation calls for the creation of a new and independent system where the main canal lies for some distance upon difficult ground, but where no pumping, storage, or diversion of other streams is requisite. Here the estimated cost for the irrigation of 17 000 acres is 58 per cent, of the annual value of crops (cotton) to be grown upon the land benefited.

According to the Irrigation Laws all irrigation projects have to be submitted to the approval of the "Dirección de Aguas y Agricultura", and it is deemed indispensable that the distribution of the water be presided over by competent and impartial authorities. The introduction of the Irrigation Code in 1902 was expected to effect a radical and immediate improvement in the irrigation of the country, but for a number of years after its enactment things went from bad to worse, few paying any heed to the provisions of the new Code and water being used, or wasted, wherever it was found. In the majority of cases the offenders were too far away from the centre of Government to enable the latter to exercise its authority. A decided improvement has come about of late, but it would be untrue to say that abuses have ceased entirely.

The greatest improvement has taken place in the province of Lambayeque, where systematic gauging of the rivers has been carried out. The districts of Chiclayo, Mochumi, Tucume, and Illimo have been mapped, and a detailed plan has been made which shows, in minute detail, the irrigated area, the distribution of the water, and the ownership of the land. The irrigation work for the distribution of the water of the Lambayeque river over the important districts of Taymi (Furreñafe), Eten, and Chiclayo has been started, thus putting an end to the many troublesome

quarrels among farmers with regard to the proper distribution of the water. The betterment of the distribution system has also been sought by the erection of an aqueduct at Jayanca, and the establishment of masonry intakes and of apparatus for measurement of the water in the main and branch canals. Careful studies have further been made for future irrigation in the Chicama valley, while the Corps of Mining Engineers has been entrusted with fresh tasks in the closer study of coast irrigation, such study having demonstrated anew the magnitude of the engineering work to be undertaken. Of other projects which are practically determined upon in addition to that in the valley of Chicama (embracing the utilisation of the water resources of that rich and important region), is some similar work in the valley of Canete, demonstrating the practicability, from a physical and economical point of view, of the irrigation of the pampas; while definite studies have been made for irrigating the valley of Tumbes, the valleys of Chira and Piura, and the coastal regions of Pativilca, Huaco, Supé, and Ilay; and also for augmenting the water of the Moche river for the betterment of irrigation conditions in the Santa Catalina valley.

In order to make the fullest use of the natural waterfalls and water-powers which are capable of artificial development, the Peruvian Government has nominated several technical commissions and appointed the State engineers to examine and measure existing waterfalls and streams with a view to their immediate or future exploitation.

**TILLAGE
AND METHODS
OF
CULTIVATION**

1091 — **The Lasting Benefits of Soil Blasting.** — *Scientific American*, Vol. CXIX, No. 13, pp. 253 New York, September 28, 1918

Back among the hills of Georgia an interesting experiment in subsoil blasting has been in progress for the past four years. The soil in this district is of a rich upland grade, and the subsoil is red and very hard. In 1914, two acres were measured off. One was left for a check acre, the other was subsoiled with dynamite. Charges were exploded with blasting cap and fuse every 15 feet, 30 inches deep. This thoroughly shattered the hard, red clay, making cobweb fissures in all directions and thus permitting more water to enter than had before been possible. The roots also benefited by the breaking up of the subsoil, new avenues being opened up for them to go out in search of plant food.

Both acres were planted with cotton in 1914. Both received the same cultivation and care, through the subsoiled one got a little more fertiliser than the other. The difference in this respect was not nearly enough, however, to account for the discrepancy between the yield of 1804 pounds of seed cotton for the blasted acre and 912 pounds for the unblasted plot.

Maize followed in 1915. This year both plots received identical treatment and fertilisation. They were both kept well worked and clean. The yield of maize in the husk was 2614 pounds for the blasted acre, 1849 pounds for the other. Owing to the wet weather, it was impossible to weigh the fodder; there were, however, 225 bundles on the blasted acre against 115 bundles on the check acre.

In 1916, the plots were under cotton again, and the benefits of the blast-

ing were more pronounced than ever. From the very start of the growing season, the cotton on the subsoiled acre outgrew the other, and by mid-summer it was at least twice as high. It also fruited much better than that on the unblasted land, and when the yield was measured it was found to have been exactly twice as productive : 2000 pounds against 1000.

In 1917, maize was once more planted on the two test acres. The blasted acre yielded $42\frac{1}{2}$ bushels of maize and three full loads of fodder ; the unblasted acre, 35 bushels and barely $2\frac{1}{2}$ loads of fodder. The obvious conclusion was, therefore, that the blasting had been a profitable investment. The increased yields soon took up the initial cost, leaving all subsequent crop increases as net profit. This is good farming as well as good business.

1092 - **The Use of Sugar-Cane Molasses as a Fertiliser.** — I. INDIET (introducing the Work of M. de SORNAV), in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 28, pp. 737-738. Paris, July 30, 1910

MANURES
AND
MANURING

M. DE SORNAV, the Director of the Agricultural Research Laboratory of the "Colonial Engrais Chimiques" at Port Louis (Mauritius), draws attention to the importance of sugar-cane molasses as a fertiliser. The market value of this substance is very small, and the results obtained with it in Mauritius and numerous cane-growing districts leave no doubt as to its efficacy as a fertiliser. It is used after having been thrown on the dung-heap for the purpose of hastening its decomposition, or mixed with sugar-refining residue and ashes, that is to say, in the form of an actual compost known as "saccharogene", which is thrown in a concentrated condition into the trench before planting, or placed at the base, or spread between the rows.

According to the experiments mentioned by M. DE SORNAV the increase in yield thus obtained varies from 5 to 10 %.

M. DE SORNAV has investigated the reasons for the increase in yield, small though it is, obtained from sugar-caues that have been manured with molasses. He carried out most careful experiments with a view to determining whether the presence of sugar was favourable to microbial action in the subsoil, and to the fixation of nitrogen, and how far, under the influence of the disappearing sugar the elements of the soil became disintegrated and transformed into more soluble substances. The results which he obtained were, however, not sufficiently conclusive to permit of his attributing the efficacy of cane-molasses to any of these causes. In short, its utility does not seem to depend upon its potash content. Although M. DE SORNAV has thus been unable to solve in a satisfactory manner the problem he set himself, he does not deny the efficacy of molasses as a fertiliser.

1093 - **Ammonification of Manure in the Soil.** — CONN, H. G. (Associate Bacteriologist) and BROUNT, G. W. (Assistant Bacteriologist, New York State Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XVI, No. 12, pp. 313-330 Washington, March, 1919.

The importance of the ammonification process in the soil has long been recognised, although there has been a tendency on the part of investigators

to regard it as secondary in importance to nitrification in so far as regards soil fertility. GAINNEY, however, has recently claimed that the fertility of a soil is limited by a process which precedes nitrification — namely, ammonification — rather than by nitrification itself.

The present study was undertaken for the purpose of determining some of the organisms which actually cause the ammonification of manure in soil under natural conditions; to ascertain the extent to which they can carry on this ammonification; and to compare them with other organisms known to possess the power of ammonifying laboratory media. Thus, in one soil, after manuring it was found that non spore-forming organisms developed most, while in the same soil before manuring spore-forming bacilli were abundant. This would tend to show that non spore-forming bacilli rather than spore formers are the active agents in ammonification.

Experiments were made with pure cultures of two organisms isolated from the former class, *Pseudomonas fluorescens* (Flügge) Migula and *Pseudomonas caudatus* (Wright), Conn, and compared with an organism of the other class, *Bacillus cereus* Frankland, in sterilised manured soil. The results obtained confirm the above-mentioned general conclusions.

1094 - **The Treatment of Dung and Excrement in Beccari Zymothermic Chambers.**

— See No. 1226 of this *Review*.

1095 - **"Electro-Potash", a Swedish Potassic Fertiliser, and Its Action on the Soil.**

— EHRENBERG, P., NOELDE, O., HASLINGER-HAHN, E., and VAN ZIL, J. P., in *Journal für Landwirtschaft*, Vol. I, XVI, Part 4, pp 209-240 Berlin, 1918 (1919).

"Electro-potash" (1), which is obtained by the reduction in an electric furnace of rocks containing potash, is a slag of a dark colour, which is ground and sifted before being put on the market. The sample sent to the authors for examination contained 11.27 % of potash soluble in hydrochloric acid "Electro-potash" may be regarded as usually containing 11 % of potash combined with silicic acid; 94 % of this is soluble in 20 % hot citric acid in 1 hour, whereas 2 % hydrochloric only dissolves 6 %. The experiments of the authors were carried out for two consecutive years", "electro-potash" being compared with potassic salts and with manure containing 15 % of nitrogen. These fertilisers were applied to sandy and clay loam soils in pots.

Winter wheat and buckwheat were the plants used in the experiments, 6 crops of each being grown each time. It was found that the yields obtained with "electro-potash" were very low, even when it was used together with lime: 12 % of the potash from the "electro-potash" was recovered in the crop, whereas 70 % of the potassium sulphate and chloride were recovered. The results were practically the same in the case of all the soils employed in the experiments. The writers, however, are of opinion that it is quite possible that other results would be observed in peaty soils, but while reserving their final opinion until further experiments

(1) See R. 1914, No. 420. (*L.d*)

have been made, they are inclined to think that "electro-potash" cannot be compared with ordinary potassic salts as a fertiliser even for peat soils.

1096 - **The Utilisation of the Energy of Waterfalls for the Manufacture of Nitrogenous Fertilisers.** — LEVY-SALVADOR, PAUL and CORE, E. F. in *La Houille Blanche*, Paris, September-October, 1918. Summarised in *Annales de la Science agronomique*, Year XXXVI, Nos 4-6, pp. 220-221. Paris, April-June, 1919.

M. LÉVY-SALVADOR recalls the fact that 1 kilowatt-year is sufficient to fix 450 kg. of nitrogen as cyanamide and only from 120 to 130 kg. as nitric acid (by the BIRKELAND and EYDE process).

In the manufacture of nitrates, which was studied by the War services, some new processes were used that are still kept secret, but could be used commercially. It would be a matter of interest to the latter to follow the application of another process besides the one carried out in the BIRKELAND and EYDE furnace, and giving a larger yield than this method.

M. LÉVY SALVADOR mentions that a factory cannot do with less than 10 000 kw., and makes the very suggestive remark that, in order to make, by means of the BIRKELAND and EYDE process, improved by G. CLAUDE (superoxygenation of the air) 200 000 tons of nitrate of lime, an amount far below the average quantity imported from Chile before the war, it would be necessary to have 140 factories each of 10 000 kw.

The net cost of a kilogramme of nitrogen, given the cost of hydro-electric energy in France, is still too high for it to be possible for artificial nitrates to compete with Chile nitrates.

M. E. F. CORE gives in the same number of *La Houille Blanche* a series of figures which are of interest in this connection.

At the end of 1918, 200 000 H. P. of "white coal" will be used in the manufacture of calcium carbide and cyanamide, nitrate of lime and nitric acid. This energy represents an annual production of 100 000 tons of cyanamide.

In 1913, only 8 000 tons were made in France, and 30 000 were made in Germany, which country will raise its output this year to 400 000 tons.

On the other hand, the HABER process, which has been carried to great perfection in Germany, has probably produced 500 000 tons of ammonium sulphate in 1918, instead of 30 000 tons, as in 1913. In 1913, France only used 30 000 tons of Chilean nitrate, that is to say, 7 to 8 kg. per hectare, as against 15 and 18 used respectively by England and Germany.

Before the war, Germany used to take annually 300 000 tons of nitrate of sodium.

1097 - **Cyanamide in France.** — *Bulletin de l'Association Italo-Française d'Expansion Économique*, Year II, No. 8. pp. 14-20. Paris, February, 1919.

Since for recovering nitric acid, one ton of cyanamide of calcium is practically equivalent to one ton of nitrate of sodium, the manufacture of cyanamide has been greatly increased in Europe during the war, on account of the difficulty of sea-transport (especially after the intensification of submarine warfare on the part of the Central Empires), which greatly diminished the amount of Chile nitrate imported.

In France, where the cyanamide industry is of comparatively recent date, and where the factories existing before the war could not have produced more than from 25 000 to 30 000 tons, the programme of the Minister of Munitions provided for the establishment of new factories for the larger and forced output of 300 000 tons, which corresponded to a normal production of 150 000 or 200 000 tons.

At the present time, the factories are finished, or nearly completed, and as they are no longer needed for the production of nitric acid, the problem now under discussion is how they may best be turned to account for the manufacture of cyanamide on a large scale, with the object of employing it as a fertiliser. The first point to be determined is what proportion the cyanamide can be used, compared with sodium nitrate and associated with sulphate of ammonia.

In order to calculate the possible, or probable, consumption of cyanamide as a fertiliser in France we must answer the following questions:—

- 1) What was the pre-war consumption of nitrogen in France?
- 2) What should the present consumption of nitrogen be in France, in order to insure the soil being adequately fertilised?
- 3) Of the total amount of nitrogen required for the latter purpose how much could well be obtained from cyanamide?
- 4) What is the net cost of cyanamide, since this factor, taken into account with the preceding one, shows how far the new factories can be satisfactorily utilised?

The nitrogen consumption in France was:

45 000 tons of nitrogen as 15.6% Chile nitrate, representing 288 461 tons of nitrate;
 20 000 tons of nitrogen as 20% sulphate of ammonia (5 000 of which were imported)
 representing 100 000 tons of sulphate of ammonia;
 5 000 tons of nitrogen derived from different sources, of which 1200 were nitrogen
 from 16% cyanamide, which corresponds to 7500 tons of cyanamide. The rest
 was nitrogen from guano, various kinds of by-products, etc.

Total 70 000 tons.

Before the war, the average wheat production per hectare in France was 14 quintals, when it was more than 20 quintals in Germany and Belgium, in the case of soils which were manifestly poorer than those of France. The reason for this is to be found in the amount of nitrogen used per hectare, 8 kg. in France, and 24 kg. in the other two countries.

Properly speaking, the nitrogen consumption in France ought to be trebled. On this point, all competent authorities agree. It is absolutely necessary that the amount should be doubled, and to do this would require 140 000 tons of nitrogen, instead of the 70 000 tons used previous to the war.

With a proper system, it is possible (following the example set by Germany), to use in equal amounts nitrates and ammoniacal fertilisers including cyanamide.

Therefore, the consumption should be as follows:— 70 000 tons of Chile nitrate nitrogen, which represents 448 717 tons of nitrate, and 70 000 tons of nitrogen derived from ammoniacal products. Since gas works,

coke ovens, guano, and various by-products supplied 20 000 tons of nitrogen before the war (subtracting 5 000 tons obtained from imported ammonium sulphate), and since after the re-construction of the factories in the North, the new coke ovens will increase this amount by 10 000 tons at most, at least 40 000 tons of nitrogen must be obtained from the cyanamide factories; this amount corresponds to an annual output of from 200 000 to 220 000 tons.

From these figures it is seen, that even counting the annual imports of Chile nitrate, which amount to from 228 000 to 448 000 tons, there is still need of the 200 000 tons of cyanamide that represented the normal peacetime output of the factories which have been installed at the instigation of the Munitions ministry.

The net cost of crude cyanamide can be calculated according to the following formula: - -

$$80 \text{ fr.} + 3 \cdot 500 K + 0.75 r + 0.02 e + S:$$

where K is the cost of the kw. hour, r that of a ton of coal, e the cost of a ton of electrode and S that of the sacks. The sum thus obtained does not include the expense incurred in making the crude cyanamide suitable for use as a fertiliser, which may be roughly reckoned at 30 fr. per ton.

On the basis of from 300 to 301 francs, a price to which we may soon hope to see the price of a ton of carbide fall, the cost per kg. of the nitrogen in the cyanamide may be estimated at from 1.70 fr. to 1.80 fr. This cost must fall again in four years' time (owing to the price of carbide and the suppression of manufacturing licenses) to from about 1.05 fr. to 1.35 fr.; the corresponding cost of a ton of cyanamide is, in francs, 340-360 and 210-270. The net cost per kg. of nitrate of sodium nitrogen which, in 1911, was only 1.17 fr., rose shortly before the war to 1.66 fr., and owing to the present general rise in prices, there is little hope of its being reduced, especially since there will be no reduction in the export duty of 0.40 fr. per kg. of nitrogen imposed by the Chilean Government. It will certainly not be possible to abolish this tax, since the whole fiscal system of Chile rests upon it, the utmost that can be hoped for is that it might be reduced as a temporary measure of commercial warfare. In that case, the cost per kg. of the nitrate nitrogen would never fall below 1.46 fr.

In short, while at the present moment, it must be admitted that the kg. of cyanamide nitrogen costs 0.24 fr.-0.34 fr. more than the kg. of nitrate nitrogen, in the future, on the other hand, it will cost 0.11 to 0.31 less. For this reason, in the interests of the future of agriculture in France, cyanamide production should still be protected, in some manner, from the severe competition of sodium nitrate.

In addition to the interest there is in keeping the cyanamide factories running which were established during the war, such a protective measure would prevent the hydro-electric industry being too hard hit. This latter industry, according to the suggested programme, would annually use about 800 000 000 kw-hours, corresponding to a constant force of over 135 000 H. P. at an annual cost of 15 to 20 million fr. Against this pro-

of dahlia tubers 13.441 gm. ; 1 kg. of carrots 9.17 gm. ; and 1 kg. of turnips 6.404 gm. These figures differ considerably from those quoted above, owing to the large amount of water in the roots and tubers analysed.

The writers also give the percentage composition of the ash obtained from the same roots and tubers. These data show that :— there is a larger quantity of sulphur in the roots of the thistle and turnip than in those of any of the other roots examined ; the highest phosphorus content is found in the water-lily, carrot, and potato ; lime is most abundant in the gentian and the dahlia ; magnesia in the root of the male-fern and the gentian ; and that the roots of the male-fern, gentian, and nettle contain the largest percentage of iron

1103 - Distribution of the Nitrogen in some Seeds and of the Nucleic Acid in Brewers' Yeast as determined by the Van Slyke Method. — See No. 1180 in this Review.

1104 - Notes on the Hydrocyanic Acid Content of *Andropogon Sorghum*. - MANMATHANATH CHOSE (Sabour Agricultural College), in *The Agricultural Journal of India*, Vol. XVI, No. 1, pp. 107-115, 7 tables. Calcutta, January, 1919.

It has long been known that a cyanogenetic glucoside, called dhuririn, is present in sorghum at certain stages of its growth. This glucoside is not poisonous by itself, but it breaks up in contact with an enzyme that is present in plant tissues, into several compounds, one of which is hydrocyanic acid, to which must be attributed the not infrequent cases of cattle poisoning by sorghum. The author made a trial to find out the effects of different times of planting, and also of water-logging on the formation of the cyanogenetic glucoside in sorghum. The results of experiments carried out on different plots showed that the time of planting by itself has little, or 1.0, connection with the formation of the glucoside, but on the other hand a crop planted late has a much better chance of producing smaller quantities of the poison, on account of the abundant moisture present which hinders its formation. Therefore, although the date of sowing has no direct effect upon the development of the glucoside, nevertheless, as the presence of the latter depends upon the dryness of the soil, it also depends indirectly upon the time of sowing, according as to whether this falls in a dry period, or in a wet one when the plants are exposed to more or less heavy rain.

Hence it would appear that the weather is mainly responsible for the development of the poisonous element in sorghum. The soil is only of minor importance, although some writers have found that the addition of nitrogenous fertilisers to poor soils causes a very slight increase in the amount of this cyanogenetic glucoside.

1105 - The Localisation of the Alkaloid Present in *Isopyrum thalictroides*. — MIRANDE, M., in *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 6, pp. 326-327. Paris, February 10, 1919.

The writer has studied, from the microchemical point of view, isopyrin, the alkaloid discovered in *Isopyrum thalictroides* L., and isolated from the latter by HARSTEN ; he also gives some information regarding its localisation in the plant

Isopyrum is a spring plant whose aerial organs appear after the flowering season, whereas the underground perennial portions continue growing throughout the year. The alkaloid is principally to be found in the subterranean organs, the rhizomes and roots, though it occurs in smaller quantities in the aerial ones, being chiefly present in the epidermis and the peripheral layers. There seems to be none in the flower.

1106 - **Anatomical Modifications of Roots Due to Mechanical Action.** — BONNIER, G., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXIX, No. 1, pp. 195-197. Paris, July 28, 1919.

In a preceding paper, the writer described the first experimental results obtained from subjecting the stalks and roots of various plants to external pressure.

His present work was undertaken, partly with a view to the experimental reproduction of certain dissymmetrical structures observed in plants growing in stony soils, or in the crevices of rocks, and partly for the purpose of determining the factors which act upon roots and stems that grow in various media (air, soil, water), and therefore present the remarkable anatomical differences to which attention has been drawn by CONSTANTIN (1).

The writer has been able to discover that compression, though it produces very important local modifications, does not affect the general development of the plant, which flowers and bears fruit normally.

From the sum total of the results obtained, the writer draws the following conclusions —

Certain tissues vary according to the mechanical action of the environment (the nature of the medium, external compression) — these may be called "adaptive tissues". Such are either protective tissues like the epidermis, or also reserve tissues like the pith.

The other tissues, which may be called "the functional tissues," continue developing almost normally in every case. The wood vessels may be less numerous or narrower than those of the control specimens, but they nevertheless are present, and are only modified as a whole. The same may be said for the phloem; the internal phloem is present, even when the pith, which it usually surrounds, has disappeared.

In short, it is possible to reproduce experimentally not only the dissymmetrical structures that are found in nature, but also the anatomical modifications resulting in certain cases from the effect of environment.

The principle explaining these phenomena might perhaps be discovered by further experiments carried out on the similar lines.

(1) J. CONSTANTIN. Influence du milieu sur la racine (*Annales des Sciences naturelles*, Seventh Series, Vol. I, 1885). Étude comparée des tiges aériennes et souterraines des Dicotyledones (*Annales des Sciences naturelles*, Sixth Series, Vol. XVI, 1883). (Ed.)

1107 - **The Absorption of Mineral Salts by the Apex of the Root.** — COURIN, H., in *Comptes rendus de l'Académie des Sciences*, Vol. 169, No. 5, pp. 242-245. Paris, August 4, 1919.

After having found that the root tip absorbs some of the water in which it is immersed, the author tried to discover whether the mineral salts dissolved in the water can also penetrate into the plant through the root tip, and whether this endosmosis by itself is sufficient to ensure the nutrition of the organism. In these experiments, as in the preceding ones (1), the germinating seeds were kept for some days in a humid and aerated atmosphere. Only the apex of the root was immersed in the liquid. In the case of each variety of plant the roots of some individuals were placed in redistilled water, and those of others in Knop's solution.

Every 24 hours, the germinating seeds were raised, so that only the tip of the root was immersed. The results obtained with a large number of species were precisely identical, therefore the author contents himself with mentioning 3 examples: (grey peas, *Ricinus sanguineus* and white lupin). Of these he gives the root length, the number of rootlets, the length of the stalk, or stem, and then describes the appearance of the leaves, both in the case of the plant grown in redistilled water, and in that of the plant in Knop's solution. The data in the latter case were noted at regular intervals of 24 hours.

The sum of these data, which are the result of morphological examination alone, proves, without it being necessary to determine the dry weight of the plants, that each individual of which the root-tip was immersed in Knop's solution had developed considerably more than the control plants growing with the apex of the root in re-distilled water. This difference is due to the fact that, in the first case, the nutrient salts penetrate into the root, thus permitting the plant to grow more than one which had at its disposal only its albumen or the reserve substances present in its cotyledons. Hence, we may conclude that the root apex is capable of absorbing mineral salts, and that the latter are largely utilised by the plant.

1108 - **The Etching of Marble by Roots in the Presence and Absence of Bacteria.** — FRED, E. B., and HAAS, A. R. C. (University of Wisconsin, Madison), in *The Journal of General Physiology*, Vol. I, No. 6, pp. 631-638 3 figs., bibliography of 11 publications. Baltimore, July 1919.

The roots of plants in the presence of bacteria have the power to dissolve the minerals present in the soil, and thereby increase the available plant food. The means by which this action takes place is a matter of considerable importance.

It has long been known that the acid excretion from roots can etch marble. In order to determine whether the presence of bacteria intensifies the process, the writers carried out several experiments with Canada field peas some of which were bacteria-free, while the others were inoculated with bacteria. Fred's apparatus (2) was used, as it allows of higher

(1) See *R*, May, 1919, No. 578. (*Ed*)

(2) See No. 1101 of this *Review* (*Ed*)

plants being grown for a long time free from any microorganisms. The seeds in each vessel were placed directly over small polished marble slabs, in such a manner that it was possible for the roots, as they grew downwards, to come into intimate contact with the polished surface of the marble. When the seeds had grown for seven days, several of the tubes were inoculated, and in order to avoid increased growth due to the presence of nitrifying bacteria, the latter were purposely omitted from the mixture of pure cultures of bacteria with which the soil was inoculated instead of with soil extract. The following bacteria were used: *Azotobacter*, *Bacillus aerogenes*, *B. coli*, *B. communior* "C", *B. communis* "B", *B. Hartlebii*, *B. avaniensis*, *B. mesentericus*, *B. fluorescens liquefaciens*, *B. fluorescens nonliquefaciens*, *B. pyocyaneus*, *B. proteus*, *B. prodigiosus*, *B. tumescens*, *B. subtilis*, *Cladothrix dichotoma* and *Cl. odorifera*.

To each of the uninoculated tubes 5 cc. of sterile water was added, in order to keep the moisture content the same in each tube. Twenty-five days after the seeds had been placed in the tubes the latter were opened, and the slabs were carefully washed and examined. It was found that, in every case, the marble slabs which had the greatest degree of etching were those taken from the inoculated tubes, hence it may be concluded that the presence of the bacteria had intensified the action of the roots.

It seems probable that the greater etching power of the roots in presence of soil bacteria can be attributed to the normal carbon dioxide excretion of the living root cells, together with the carbonic and other acids set free from dead or dying root cells whose decomposition is accelerated by the presence of the bacteria. While the results indicate that the dissolving power of roots is in part due to the action of the bacteria, it must be admitted that there are many factors involved. For example, the food supply of a plant must be different in the presence of bacteria from that of a plant in soil free from bacteria.

1109 - **The Origin of Succulence in Plants.**— *Revue Generale des Sciences*, Year XXX, No. 11, pp. 332-333. Paris, June 15, 1919.

There are two types of succulent, or fleshy, plants, those growing in arid regions, as the cacti and those found near the sea; the latter are also called halophytes. Almost all succulent plants are characterised by the marked acidity of their tissues, and as many of them grow in places where the soil contains a large quantity of salts, their physical peculiarities have hitherto been regarded as owing to the large accumulation of water or cell sap, due to osmotic action.

RICHARD's discovery, however, that both thin-leaved and thick-leaved individuals exist among the *Castilleja erigeron* plants living on the coast of California, and the fact that these leaf characters are connected with the plants' water supply, have provided MACDOUGAL with the basis of a more reasonable explanation of succulence.

Plant protoplasm chiefly consists of pentosans, (for example, mucilages), mixed with a smaller proportion of protein derivatives and salts. As

succulence involves an increase in water storage, it is necessary to consider, in the first place, the water content of the cell.

A series of analyses of the carbohydrates of desert plants has shown that when cells containing polysaccharides undergo a diminution of their water content, these sugars are reduced to pentosans. The imbibition capacity of polysaccharides is slight, but it is considerably increased when they are changed into pentosans. Dryness, by causing great loss of water, produces a change in the cell, which permits of its retaining much more water. Further, this storage capacity acquired by the cell mass is permanent, for the transformation of polysaccharides into pentosans is not reversible.

Finally, it has been found that the acidity of *Castilleja* plants with thin leaves is nearly double that of those with thick leaves, which suggests the idea that succulence can develop in plants with high acidity, or rather in those of a type of metabolism producing great acidity.

1110 — **The Action of Fluorides on Plants.** — GAUTIER, A. and CLAUSMANN, P., in *Comptes rendus de l'Académie des Sciences*, Vol. 169, No. 3, pp. 115-122. Paris, July 21, 1919.

The preliminary cultural experiments made by the writer in pots, and on entirely artificial media (1) with or without the addition of fluorine, did not sufficiently show the effect of fluorine upon plant growth. He therefore resolved to make some field experiments.

The soil of the field selected for this purpose was sandy clay, with scarcely any lime and containing in its natural condition 88 mgm. of fluorine per kg; to all the lots treated with fluoride, 55.8 mgm. of amorphous calcium fluoride was applied per sq. m. to a depth of 0.25 m., which corresponds to 100 mgm. of fluorine per kg. of soil. The field had lain fallow for 2 years, and its surface had been divided into 18 pairs of equal plots, separated from each other by a space of 0.90 m. One plot in each pair was treated with fluoride and the other one was not. As the addition of calcium fluoride necessarily introduces a small quantity of lime, care was taken to add to each of the control plots, the equivalent amount of powdered chalk.

In their experiments, the writers used the most commonly grown plants; wheat, oats, carrot, potato, beet, haricot beans, cabbages, poppy, peas, barley, etc. Each of the plants was respectively grown in the plot to which the fluoride had been added, and in the control plot. The writers give the comparative (qualitative and quantitative) results obtained, which may be summarised as follows: --

Wheat: increase in total crop 13 %; increase in grain yield 18 % — *Oats*: increase in crop 12 %; increase in grain yield 5.2 % — *Carrots*: gain in plots with added fluoride 17.9 % — *Potatoes*: slight superiority the first year, then in second year gain of 58.7 % — *Beets*: deficit in plots with added fluoride — *Peas*: slight superiority of plots treated with fluoride: 5.7 % more the first year, and 12.6 % the second — *Haricot beans*: no difference — *Cabbages*: no difference in crop the first year; apparently

(1) See *R.*, July-Sept., 1919, No. 549 (*Ed.*).

the fluoride had not a good effect — *Poppy*: gain of 14 % in the plot treated with fluoride.

Thus, other conditions being equal, the addition of fluorides, especially of amorphous powdered calcium fluoride, to arable soil has a beneficial effect upon wheat, oats, carrots, peas, poppies, and potatoes. The writer mentions that crystallised calcium fluoride, or natural fluophosphates are not equally efficacious. Rye, barley, buckwheat, haricot beans, and mustard are unaffected, or but little affected, by this fertiliser. Beet, turnips, and onions are injured by fluorides. All these plants were grown in the open on poor soil to which no fertiliser had been added except 0.200 gm. of amorphous calcium fluoride per kg. of soil.

Given the slight solubility of calcium fluoride, the amount could easily have been doubled, or trebled, and more decisive results might have thus been obtained. Perhaps plants with a higher fluorine content than usual could have been produced.

As fluorine always accompanies phosphorus in the tissues, being assimilated and eliminated with it, and as it seems to insure the fixation of this element which itself has a great effect in stimulating the reproduction of tissues, a considerable increase in the vitality and fertility of agricultural crops is naturally to be expected from the combined use of fluorides and phosphates.

As regards the utilisation of fluorine in dietetics, it must be remembered that the human organism eliminates it by means of epidermal excretions (fluorides and fluophosphates). In these forms, it cannot be directly assimilated by the animal organism, which depends chiefly upon plant food for its supply of available fluorine.

1111 — The Effect of Aluminium Ions upon the Germination and Growth of Plants.

— STOKLASA, JULIUS, in collaboration with SEBOR, J., ZDOBNICKY, W., TYMICH, F., HORÁK, O., NEMEC, A., and CWACH, J. (Upper Technical School of Prague), in *Brochemische Zeitschrift*, Vol. 91, Parts 3 and 4, pp. 137-223, 15 figs., 11. Tables. Berlin, October, 1918.

The metals belonging to the aluminium group which occur most commonly in the plant organism are iron, aluminium and manganese. Aluminium is found above all in hydrophytes and hygrophilous plants; it is present, however, also in mesophilous plants; xerophytes, as a rule, contain much smaller quantities of this substance (1).

Manganese appears to be present throughout the plant organism in more or less variable amounts. It should also be mentioned that the iron and manganese are chiefly localised in the epigeal portions of the plant, whereas the aluminium accumulates principally in the roots, rhizomes, tubers and bulbs.

The author and his collaborators, continuing their study of the physiological part played by aluminium in the plant organism, describe the experiments they carried out for the purpose of determining the effect exerted by the ions of manganese and iron upon plant germination and growth, and the influence of the electrical conductivity upon both these processes.

(1) See R, December, 1918, No. 1339. (Ed.)

The effect of aluminium. — A concentration of aluminium of from 0.0001 to 0.0002 of the atomic weight, in the form of chloride, not only had a favourable effect upon the germination of the seeds treated, as was shown by comparing them with the control seeds (for which only distilled water was used), but also considerably increased the total yield of the plants subjected to the experiment (*Hordeum distichum*, *Triticum vulgare*, *Pisum sativum* and *Lepidium sativum*).

If the concentration is increased (successively to 0.0005, 0.001, 0.002, 0.005 and 0.01 of the atomic weight), a gradual retardation of germination, which becomes more and more accentuated, is observed, while the decrease in the total yield of the plant becomes steadily more noticeable, the toxic action of the aluminium ions revealing itself with increasing distinctness, as the solution becomes more concentrated.

The effect of manganese. — A concentration of manganese of from 0.0001 to 0.0005 of the atomic weight, in the form of chloride, greatly promotes germination and the germination faculty and increases the total yield of the plant. A concentration of 0.002 has an unfavourable effect, and a still more concentrated solution (0.005 to 0.01) has a distinctly toxic action.

The effects of aluminium chloride and manganese chloride when used together. — These effects show the mutual antagonism of the aluminium ions and the manganese ions. The action of a concentration of manganese of 0.005 of the atomic weight is counterbalanced by a 0.0001 concentration of aluminium, and in this case, an increase in the yield of the plant is noticeable. A 0.002 concentration of aluminium does not act as an antidote to the same concentration of manganese (*Hordeum distichum*, *Triticum vulgare*, *Pisum sativum*). A highly concentrated solution of manganese combined with a highly concentrated solution of aluminium has a toxic effect that greatly hinders the development of the plant.

The action of the aluminium ion on plant growth. — *Xerophytes.* — A 0.001 solution of aluminium, in the form of the sulphate, used per litre of the culture solution, has a toxic action manifesting itself after 14 days by the arrested development of the plants; the same result is produced by a 0.002 solution at the end of 24 days, although the plants do not die. A 0.003 solution kills the plants in 18 days.

Hydrophytes and hygrophilous plants. — Concentrations of 0.0005 and 0.00075 of aluminium have a very favourable action upon the development of hydrophytes and hygrophilous plants; a 0.001 concentration is also very beneficial to the growth of *Carex riparia*, *C. sylvatica*, *C. vesicaria*, *Ranunculus fluitans*, *Galeopsis versicolor* and *Caltha palustris*. Even in the case of aluminium concentrations rising from 0.002 to 0.006, these plants showed no ill effects after 48 days. Stronger solutions (0.0075 to 0.0095) have a slightly injurious action on the development of *Ranunculus arvensis*, *Caltha palustris*, *Symphytum officinale*, *Pulmonaria officinalis*, *Rumex Acetosella*, *Ranunculus fluitans* and *Geranium pratense*. Plants of the genus *Carex* have a special power of resisting the action of the aluminium ions; they can even withstand a 0.02 con-

centration, and only die when the concentration reaches 0.05 (after 10 or 20 days)

Mesophilous plants. — A 0.00075 concentration of aluminium exercises a deleterious effect upon the plants of this group. The action of a 0.00075 concentration of iron is also injurious, but when the solution consists of a mixture of iron and aluminium of this concentration, the antagonism of the two ions is proved by the favourable effect upon the development of plants. The antagonism existing between iron and aluminium is still more marked when a very strong solution of the former (0.002 for instance), is used at the same time as a weaker solution of the latter (0.0005). This fact, which is analogous to that cited above in connection with the aluminium ion and the manganese ion, shows that the aluminium ion has considerable power as an antidote in the metabolism of the plant organism. The antagonism exerted by aluminium decreases with the increase of its concentration, and ceases at a concentration of 0.0015. This power exerted by the aluminium ion over the ferrous, ferric and manganese ions is not reciprocal.

In comparing the relative toxic effect of the three substances, aluminium, iron and manganese, we find: 1) unfavourable action retarding the development at a concentration of 0.005 for iron, aluminium and manganese in the form of sulphates; 2) death of the plants at a concentration of 0.01 in the case of aluminium, 0.006 in that of iron, and 0.008 in the case of manganese.

The electrical conductivity of culture solutions in relation to the processes of germination and development of plants. — The writers have determined the electric conductivity of the solutions used (chloride of aluminium, chloride of manganese, sulphate of aluminium, sulphate of manganese, and a mixture of these different solutions). The results thus obtained were compared with the effects upon the germination and growth of the seeds and plants experimented upon. The comparative examination of the amount of physiological influence exerted by the ions and the extent of the dissociation of the salts, revealed the existence of a parallelism between these two factors.

It was also observed, that the seedlings of mesophilous plants are, as a rule, more susceptible to the action of aluminium ions than to that of manganese ions, and that the adult plant is less susceptible to aluminium ions than to ferrous, ferric, or manganese ions. This phenomenon is explained by the fact that in the case of the adult plant, the aluminium is chiefly localised in the root system, whereas the iron and manganese form part of the chlorophyll. In the root system of the higher plants, the exchange of the ions reaches its greatest importance. In the seedlings, the aluminium is distributed throughout the organism thus giving rise to toxic effects.

Apart from dissociation, hydrolysis (which becomes intensified as the aluminium solution becomes more dilute and hence with the increased concentration of the hydrogen ions) also appears to have a very toxic action upon germination.

- 1112 - **On the Assimilation of the Dicyanodiamide Derived from Calcium Cyanamide** (1). — MOLLER, L. (University of Breslau), in *Biochemische Zeitschrift*, Vol. 88, Pt. 1-3, pp. 95-96. 4 tables, bibliography of 22 publications. Berlin, June, 1918.

Calcium cyanamide, when used as a fertiliser, must undergo certain transformations in the soil before it is capable of assimilation by plants. Experts, however, do not agree as to the nature of these changes. Some are of opinion that the cyanamide derived from a fertiliser cannot be directly assimilated, but others (ULPIANI, PEROTTI) consider that the polymer of this cyanamide, that is to say, dicyanodiamide, is an excellent source of nitrogen for the use of plants. With a view to testing the value of this opinion, the writer cultivated various micro-organisms on mineral media, giving them dicyanodiamide as their only source of nitrogen, with the result that the growth of the plants was much reduced, and in some cases, almost arrested. The micro-organisms appeared unable to transform into albumen the nitrogen from the dicyanodiamide, for after having been grown for a short time on a mineral medium + dicyanodiamide they had a large nitrogen content amounting even to 60 % of their dry weight. Only a small portion of this nitrogen was, however, present in the form of protein. As in the case of the higher plants, the dicyanodiamide had accumulated unaltered in the cells. These same cultures on mineral media grew very well when the dicyanodiamide was replaced by sulphate of ammonia, or if these two nitrogenous compounds were added at the same time.

- 1113 - **The Pre-Determinant Influence of the Physiological Condition of the Seed upon the Course of the Subsequent Growth and Yield of the Plant.** — I. KIMB, F. and WEST, C., Influence of the Degree of Maturity of the Seed at the Time of Harvesting, *Annals of Applied Biology*, Vol. V, Nos. 3 and 4 pp. 157-170, 10 tables, bibliography of 25 publications. — II. IDEM, Influence of Condition of Environment during Germination Upon the Yield. *Ibid.*, pp. 220-251, 12 tables, bibliography of 44 publications. London, April, 1919.

I. — After having studied the effect of soaking seeds in water (2), and the influence exerted by the parent plant (3) upon the course of the subsequent growth and yield of the offspring, the authors continue their study of the pre-determinant influence of the seed upon the plant.

In the article summarised, they treat of the effect which the greater, or less, maturity of the seed at the time of harvesting exerts upon its germinative energy or potentiality. A very complete review is given of the publications dealing with the subject, and of the different results obtained by other investigators. A consideration of these data makes it clear that the question as to whether differences in the resulting plant are pre-determined by the use of seeds differing in degrees of ripeness cannot be regarded as satisfactorily answered in the case of any single species. This is due to the fact that all the recorded comparisons between plants grown from immature seeds, and plants grown from mature seeds, appear

(1) See also No. 1098 of this *Review*.

(2) See also *R.*, December, 1918, No. 1341. — (3) See *R.*, February, 1919, No. 177. (*Ed.*)

to have been complicated by some period of storage. Immature seeds are less tolerant of storage in the dry condition than mature seeds, so that in the case of the comparisons that have been made, the total yields from immature seeds are usually less than those from mature seeds, owing to the fact that a smaller percentage of the former germinate. When, in such experiments, comparisons are made between yield per plant, however, the difference in favour of the plants from mature seeds tends to disappear, or even to be reversed. This result may be significant, but it must be remembered that while the yield per plant in the case of the mature seeds represents an average based on the total number (which includes both vigorous and weak plants), the yield per plant, in the case of the immature seeds, on the other hand, probably represents an average based on the more vigorous individuals only, the others having perished during storage in the seed stage.

From the practical point of view, seed harvested at a stage somewhat previous to maturity may, under certain conditions, give a better yield than seed allowed to become dead-ripe upon the parent plant, but seeing that immature seed does not withstand storage well, its use is not to be recommended.

II. — In this article, the writers treat of the effect of conditions during germination and in early seedling stage upon subsequent growth and final yield. These conditions were modified artificially by 1) the total, or partial, removal of the cotyledons, endosperm, etc., 2) soaking the seeds in water, or impregnating them nutrient salts; 3) inoculating the seeds with enzymes.

It may be stated that the conditions operating during germination and the early life-cycle of the plant are of the utmost importance, especially in the case of annuals and biennials, i. e., in the case of the majority of economic crops. These conditions exercise a pre-determining influence upon subsequent growth, and directly affect the yield. In many cases, the value of the effects obtained is, from the economic point of view, out of all proportion to the cost of the treatments used.

It is recognised that some sort of correlation exists between the vigour of the seedling and that of the adult plant, but this vigour may be due either to hereditary or to environmental factors that have operated previous to, or during, germination and which, as we have seen, greatly affect the subsequent development of the plant. It is, therefore, necessary to determine by the help of experimental work, whether a law can be propounded to the effect that increased vigour of seedling development due to environmental conditions as distinct from hereditary causes is correlated with increased vigour of growth throughout the life of the plant.

1114 — **The Calvino Method of Increasing Leaf Development in Some Kitchen-Garden Plants.** — REYES A. L., in *Revista de Agricultura, Comercio y Trabajo* (1), Year 2, Vol. II, No. 6, p. 286, 3 figs. Havana, June, 1919.

Prof. MARIO CALVINO, the Director of the Agricultural Station at San-

(1) See also: *Revista de Agricultura, Comercio y Trabajo*, Year 1, Vol. I, No. 10, pp 505-510. Havana, October, 1918.

tiago de la Vegas, Cuba, advises as a practical method to be adopted in intensive kitchen-gardening, the perforation of the primary root in a horizontal direction. In this manner, greater foliar development is obtained in plants which, like chicory, lettuce, parsley, etc., are grown for the sake of their leaves. The writer tried this method upon parsley at the above-mentioned Station. The plants used for the experiment attained a diameter of 80 cm., and a height of 4 cm., the measurements of the control individuals being respectively 55 and 30 cm.

1115 - **Intra-organic Injections for the Purpose of Increasing the Yield of Plants: Experiments in Mexico and Cuba.** — CALVINO, M (Director of the Agricultural Station at Santiago de las Vegas, Cuba) in *Revista de Agricultura, Comercio y Trabajo*, Year 2, Vol II, No 6, pp 267-291, 6 figs Havana, June 1919

Although the Russian botanists were the first to study the effect of injections upon plants, the credit of applying this treatment to a definite agricultural purpose belongs to Prof. PERRI, of Paris. When the writer was Director of the Central Agricultural Station of Mexico, he carried out, in 1912, a series of experiments with a view to determining the practical value of these injections. An old pear tree, which was covered with blossom every year, but never bore fruit was subjected to the following treatment: at a little distance above the level of the ground, a hole extending as far as the fibro-vascular bundles was bored in the trunk. Into this hole was inserted a small glass tube communicating by means of rubber-tubing with a vessel (placed 1.5 m. above the ground) containing a nutrient solution composed of water 18 litres + sulphate of iron 19 gm. + nitrate of sodium 10 gm. The tree absorbed the solution in about 3 days. The following month, the leaves were larger and brighter in colour than those of the control trees (two old pear trees which, like the first one, flowered freely, but produced no fruit), numerous fruits set and developed well, whereas the control trees bore no pears.

In 1913, the writer made another experiment on a sterile pear tree. He used the following solution: water 20 litres + superphosphate 5 gm. + sulphate of potassium 5 gm. + nitrate of sodium 5 gm. + sulphate of iron 5 gm. The pear tree absorbed more than 50 litres of this solution just before the moment of flowering. It was well-covered with blossom and bore fruit. A lilac grafted on a privet was treated in the same manner, and produced a larger number of finer flowers.

The writer continued his work at the Agricultural Station of Santiago de las Vegas, where he experimented upon caryas.

This operation method opens up new fields of work — the injection of virus into plants suffering from bacterial diseases; the injection of vegetable substances (camphor, etc.) to induce vigorous growth; the injection of a solution of the product for which the plant is cultivated (for instance sugar in the case of the sugar-cane), in order to induce the "habit of the substance", and thus obtain more productive varieties, etc

1116 - The Number and Behaviour of the Chromosomes in the Hybrids Wheat \times Wheat and Wheat \times Rye; Experiments Made in Japan. — HITOSHI, KIHARA, in the *Botanical Magazine*, Vol. XXXIII, No. 386, pp. 17-38, 21 figs., bibliography of 48 publications. Tokio, February, 1919.

In studying problems dealing with the inheritance of characters, it is necessary not only to consider them from the purely genetic standpoint, but also to take into account the cytological phenomena which lie at the base of heredity and perhaps can explain the transmission of qualities. In accordance with this principle, finding that the cytology of wheat, rye and their hybrids was still imperfectly known, the writer carried out a series of experiments on the number and behaviour of the chromosomes (1), in the heterotype and homotype divisions of the pollen mother-cells, and the embryo sac, in the wheat \times wheat hybrids (crosses being effected between different species) and wheat \times rye. At the same time, he determined the number of chromosomes in the somatic cells, using for the purpose the root-tips of seedlings of the F₁ generation

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Triticum turgidum ♀ = *T. compactum* ♂
Triticum polonicum ♀ = *T. Spelta* ♂

In the series *T. durum*, *T. turgidum* and *T. polonium*, the number of chromosomes was 28. In the series *T. vulgare*, *T. compactum* and *T. spelta* there were 42 chromosomes.

The number of chromosomes in the somatic cells of the hybrids of the F₁ generation. — The number was decided by counting the chromosomes in the equatorial plate of the cells of the root tips. The writer always found 35 chromosomes, 14 being derived from the female parent, and 21 from the male. The nuclear divisions always took place in a normal manner.

Allotypic division of the nucleus for the formation of the reproductive cells. — This consists in two successive processes: — A) the heterotype or reduction process; B) the homotype division.

A) *Heterotypic division in the pollen mother-cells.* — First phase: in the resting stage, the nucleus forms a very fine network of filaments which, at the end of the reduction process, contracts into a tight ball, leaving free a considerable portion of the nuclear cavity (first contraction, or synapsis).

2nd. phase: *dispireme*. — The filaments of the ball unroll, forming more or less complicated loops and completely fill up the nuclear cavity.

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As a general rule, the chromosomes becoming individualised during diakinesis correspond in reality to a double chromosome (gemini) of the

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somatic cells, so that in the equatorial plate, during the reduction process, the number of bivalent chromosomes should be equal to half the number found in the somatic cells.

In the cases investigated by them, SAKAMURA and the writer counted 21 chromosomes in the equatorial plate, hence we must conclude that while 14 maternal chromosomes (diploid = 28) and 14 paternal chromosomes (diploid = 42) united two and two to form bivalent chromosomes, the 7 other paternal chromosomes remained isolated and, consequently, univalent; indeed, 14 bivalent chromosomes + 7 univalent chromosomes equal 21 chromosomes.

4th. *phase: metaphinesis*. — The 14 bivalent chromosomes divide into their elements, which respectively travel to the two poles of the cell. The 7 univalent chromosomes then arrange themselves on the equatorial plane and divide longitudinally, the two halves migrating respectively to the two poles, where they totally or partially fuse with the ball of 14 chromosomes which they find at either pole.

B) *Homotypic division of pollen mother-cells*. — In each of the two cells formed by the heterotypic division of pollen mother-cells, a series of divisions (known as homotypic divisions) take place which ends in the formation of 4 cells, each containing half the number of chromosomes found in the somatic cells.

The 14 bivalent chromosomes resume their individuality at the moment of diakinesis; they split longitudinally, and the two halves travel respectively in a perfectly normal manner to the two poles of the spindle. On the other hand, the univalent chromosomes do not split longitudinally (this scission having taken place during the previous heterotypic division) but divide themselves into two groups of 3 or 4 elements, which although belated, yet travel to the poles of the spindle and there fuse with the other chromosomes. Some of the univalent chromosomes never reach the pole but stop to form a dark globular body, the chromatin nucleolus. The behaviour of the latter and the part it plays have not yet been determined by the author.

By means of the two successive divisions, the one heterotypic, the other homotypic, the pollen mother-cell is now divided into 4 microspores, in which the number of chromosomes is not always exactly equal to half the number of chromosomes present in the somatic cells.

Number of chromosomes in the somatic cells of the hybrids of the F_2 and F_4 generations — In the F_2 generation, 38 chromosomes were counted in 4 cases (2 hybrids *Triticum durum* \times *T. vulgare* and 2 hybrids *T. polonicum* \times *T. compactum*) and 35 chromosomes in 1 of the 4 cases examined, viz., in a hybrid *T. turgidum* \times *T. compactum*.

In the F_4 generation, in the 5 cases investigated, 41 chromosomes were always found.

Thus, there is a considerable increase in the number of chromosomes from one generation to another.

II. — HYBRIDS WHEAT \times RYE.

In the products of re-crossing, wheat \times (wheat \times rye), facts similar to the proceeding ones were noted: the number of the chromosomes in the somatic cells tended to increase from one generation to another, so as nearly to reach the diploid number found in the parent possessing the most chromosomes.

In fact, for 3 successive generations, the series of numbers 35-38-42 was found. Now, 42 is the diploid number of the *Spelta* type.

However, in some of the products of recrossing, an intermediate number (38) was found; this continued without alteration in the successive generations.

CONCLUSIONS.

There must be very interesting correlations between the cytological processes and the facts of heredity, for the descendants of the hybrids studied showed very different external characters. The author proposes to study these correlations.

After the progressive increase in the number of chromosomes in the somatic cells from one generation to another, the most interesting fact observed by the author, was the behaviour of the univalent paternal chromosomes. These chromosomes underwent equatorial division in the first period (heterotypic), and reductive division only in the second period (homotypic), that is to say, they behaved in the opposite manner to bivalent chromosomes.

It is generally admitted that hybrids resulting from crosses between plants possessing different numbers of chromosomes are sterile. In the cases studied by the writer, however, the sterility was only partial, and decreased with successive generations, in which, as was stated above, the number of chromosomes tends to increase.

1117 - Fertile Wheat-Rye Hybrids Produced by Crossing Experiments in the United States. — LOVE, H. H., and CRAIG, W. T., in *The Journal of Heredity*, Vol. X, No. 5, pp. 195-207, Washington, May, 1919.

The writers have made a number of crosses between wheat and rye. Most of the resulting F_1 hybrids proved sterile, though in many of their morphological characters they were intermediate between their parents. Two fertile hybrids were, however, produced, and the results obtained from one of these crosses is described in this article. The variety of wheat known as Dawsons' Golden Chaff was crossed with common rye, and from this cross one plant was obtained. This F_1 plant gave every indication of being a wheat-rye hybrid. It had a few awns developed, particularly at the tip of the head. The glumes were brown, and intermediate in character between those of wheat and rye. They were keeled (rye character) and ciliate, and there was only a slight pubescence of the peduncle.

This hybrid plant was not completely fertile, but one seed was obtained from it, and the head of this F_2 individual was much like that of

the female parent in F_1 but more awns were developed. This hybrid showed its rye parentage in many ways: not only had it a larger number of awns, as has already been said, but the glumes were more sharply keeled and more ciliate. The peduncle was not pubescent at all. From this F_2 individual, only one well-developed ripe viable seed was obtained. The F_3 plant resulting from this single seed showed fewer of the rye characters which had been conspicuous in the two previous generations, in fact, it did not show its hybrid nature to any great extent, as far as the head characters were concerned.

A number of seeds were sown from this plant, and an F_4 generation was grown. The hybrids thus obtained were very variable as regards the awns and the colour of the chaff and kernel. The colour seemed to follow a simple mendelian ratio of 3 : 1 similar to that occurring when two varieties of wheat (one pigmented and the other unpigmented) are crossed.

The ears were all more like wheat than rye, though in some respects they indicated their hybrid origin, the awns being considerably developed, and the glumes ciliated. Many of these plants resembled rye in the colour of their stems, and the general appearance of their vegetative organs. There is considerable variation as to the degree of sterility in these hybrids, some are entirely fertile whereas others (for instance Nos. 43 and 47) are nearly sterile. The shape of the kernels also varies considerably.

Some of the families of the F_2 generation have been carried further, and they continue to produce descendants that are more wheat-like as far as their ears are concerned, while the rest of the plant shows some resemblance to rye.

Some of these hybrids are now being tested under field conditions to determine whether they have inherited any of the winter hardiness of rye. If a plant could be obtained which combined the good qualities of wheat with the winter hardiness of rye, it would be possible to sow later than is now done, and to grow crops in areas where the winters are too severe for wheat.

1118 - Studies and Experiments Relating to the Analysis of the Genetic Factors of Barley. — VON UBISCH, G., in *Zeitschrift für Indultive Abstammungs- und Vererbungslehre*, Vol. XVII, Part 1-2, pp. 120-152, 14 figs., and Vol. XX, Part 2, pp. 65-117, 7 figs. Leipzig, January, 1919.

The results of a series of experiments in crossing, carried out with *Hordeum spontaneum*, and different varieties of cultivated barley, with the object of individualising and distinguishing the behaviour of the relative factors or determinants of the following characters:— 1) brittleness of rachis; 2) density of ear; 3) number of rows of grains; 4) length of awns; 5) hood, 6) length of stem; 7) covering of grain; 8) denticulation of the glumes, 9) colour of glumes; 10) hairy tuft at base of grain.

This work has furnished very interesting data respecting the attraction and repulsion of certain factors, which change the numerical ratios between the forms of the F_2 generation, and give figures that are very different from those which would be expected according to the law of the recombination of characters.

In addition to giving the data he collected in the course of his experiments, the author discusses the theories and work of previous observers, and appends to his article a table giving the gametic formulae of the 10 above-mentioned characters for all the varieties of barley examined.

BRITTLINESS OF RACHIS.—By crossing varieties of barley with a strong rachis, the writer obtained in 1915, some individuals with an extremely brittle rachis. In the F_2 generation, the ratio between the brittle and non-brittle individuals was 9 : 7. It was therefore a question of two factors **B** and **R**, of which the presente (in the homozygous condition, or the heterozygous condition) is indispensable for the production of the above mentioned character.

In the F_3 generation one group of the brittle-stemmed individuals of F_2 transmitted this character to their offspring (gametic formula in F_2 : **BB RR**), while the descendants of a second group were divided into brittle and non-brittle plants, in the ratio of 3 : 1 (gametic formula in F_2 : **BB Rr**, or **Bb RR**) and of a third group in the ratio 9 : 7 (gametic formula in F_2 : **Bb Rr**).

The analysis, on being continued in as far as F_8 , confirmed the suggested scheme. The author maintained that *Hordeum spontaneum*, considered as the ancestor of cultivated barley, would contain the two factors, **B** and **R** in the homozygous condition, **BB RR**. As a proof of the truth of his statements the writer gives the results of crossing *Hordeum spontaneum*, the pure lines H_6 and H_{37} , and a non-brittle plant obtained in the F_3 generation of $H_6 \times H_{37}$ and known by the number 0135.

The results in the F_2 are as follows :—

- 1) From *H. spont.* $\times H_6$ were obtained 34 individuals, 25 with a brittle rachis, and 9 with a resistant one. These numbers approach the theoretical ratio 2.94 : 1.06 and make **Bb RR** a gametic formula of H_6 .
- 2) From *H. spont.* and H_{37} were obtained 49 brittle and 13 resistant individuals. These numbers are very near to the theoretical ratio 3.16 : 0.84 and make **BB Rr** a gametic formula of H_{37} .
- 3) From *H. spont.* \times 0135 were obtained 314 hybrids. Of these 234 had a brittle rachis and 80 a non-brittle rachis according to the theoretical ratio 2.98 : 1.02. This would make **BB Rr** or **Bb RR** a gametic formula of 0135.

The problem is, however, not so simple as would appear from the figures quoted. The determination of "brittleness" which is easy in F_1 , becomes difficult in the F_2 and following generations, owing to the great fluctuations of this character. Between the two extreme forms, there is, in fact, a whole series of intermediate ones, which render the work of sorting and classification a very difficult task. The causes of this variability must be sought in : 1) the density of the ear ; 2) the action of external factors.

Effect of the density of the ear upon the brittleness of the rachis — The laws of mechanics prove, that *a priori* a thick and short rachis (other conditions being equal) must be less brittle than a rachis that is long and thin.

In 1918, in three plots of the F_3 generation of $H_{34} \times 27$, the writer obtained the following dissociation values :—

No. 0361 — Taking into account both plants with a loose ear, and those with a compact one, the ratio between the brittle and non-brittle plants is 34 : 37 (theoretically it should be 32 : 24, which corresponds to 9 : 7), the non-brittle individuals being in excess. On the other hand, if only the loose-eared plants are considered, the ratio is 33 : 23, with an excess of brittle individuals.

No. 0362. — Facts similar to those observed in the case of No. 0361. Taking into account both loose ears and compact ears, the ratio is 78 : 120 (instead of 71 : 56), with a larger number of non-brittle individuals. If, on the other hand, we only consider the loose ears, the ratio is 69 : 58, with a slight excess of the brittle individuals.

No. 0363 — Like the two preceding Nos.

This physiological correlation between compactness of ear and brittleness of rachis which, according to circumstances, gives an excess of brittle, or of non-brittle, plants, complicates the work of sorting and classification.

The Effects of external agents upon the brittleness of the rachis. — In a very dry environment, the character of brittleness is less noticeable, whereas in the presence of damp, it becomes accentuated. A very good example of this occurred in 1918. In the locality where the experiments were carried out, the weather was dry (with the exception of several storms) until the harvest. In the experiment field, the writer observed 23 zones, forming a slight depression, where the rain that had fallen during the storms had collected, thus increasing the humidity of the soil. In these two zones, plots Nos. 0339₄ and 0339₆, the percentage of ears with a brittle rachis was higher (from 0.43 to 0.45 %) than in the dry plots (0.24 to 0.37 %). The unequal distribution of the rainwater and the humidity of the soil, therefore, determines the important fluctuations, and still further complicates the work of classification.

DENSITY OF THE EARS. — In estimating the density of the ears, the length of that segment was measured which is included between the base of the joint where the 2nd. grain (from the bottom) is inserted, and the upper extremity of the joint where the 11th. grain is inserted. For the 12 lines of barley examined, and for *Hordeum spontaneum*, values were obtained extending from a maximum of 92 mm. in the case of *H. spontaneum*, to a minimum of 33.30 mm. in the line H₂₄, all the intermediate gradations being present. It can easily be seen how such a large number of different values must complicate the gametic order, and the importance of the number of factors playing a part in the manifestation of the phenomenon in question.

From crossing experiments, the presence of 3 factors would seem to have been established: L, M, N, which are capable of influencing, in different degrees, the density or compactness of the ear. The pure line which were used in these experiments give the following density figures and gametic formulae: —

Lines	Density in mm	Gametic formulae	Character of ears
<i>H. spontaneum</i>	92.00	LL MM NN	loose
H ₄₀	86.43	LL MM nn	
H ₂₇	86.00		
H ₁₆	85.52	LL mm NN	
H ₁₀	78.86		
H ₄	78.19		
H ₁₁	77.76		
H ₂₉	75.40		
H ₉	72.05		
H ₂₀	66.63	LL mm nn	
H ₁₅	63.61		
H ₃₇	50.44	ll MM nn	compact
H ₃₄	53.30	ll mm nn	

L is thus the most important factor and, whether alone, or in the presence of the two others, it determines the clear division of the plants into 2 classes, those with loose ears (presence of L), and those with compact ears (absence of L).

M and N have a similar, but less strong effect than L.

NUMBER OF ROWS — So far, the writer has been able to distinguish 2 factors: Z and W. When these factors occur together, we get two-rowed barleys (ZZ WW and Zz WW); in the absence of both factors (zz ww), or when W only is present (zz WW and zz Ww), the number of rows is always 6; in the intermediate cases, the number of rows varies from 2 to 6 (ZZ Ww — ZZ ww — Zz Ww — Zz ww).

This formula with the two factors Z and W is certainly not the complete and exact gametic formula, however, as may be deduced from the fact that on the one hand, types "with a number of rows other than 6" and those "with a number of rows equal to 6" always occur in the ratio 3:1, whereas, on the other hand, it is very difficult to determine the limits and ratios of the groups in which the number of rows varies between 2 and 2-6.

LENGTH OF AWNS. — There are 2 length factors: A and V.

A = factor of length and is dominant, even in the heterozygous condition (Aa Vv).

B = factor for shortness: all the aa Vv plants have short awns.

U = a factor which, when present alone, produces a short awn; on the other hand, in the presence of A, it gives rise to extreme length, just as if a short segment, U, were joined to a long segment A. When present together, U and V behave like the factors of brittleness B and R, and give awns of average length and short awns in the ratio 9:7.

The length of awns and the gametic formulae of *Hordeum spontaneum*, and the 9 lines examined, are given in the following table.—

Lines	Length of awns in cm.	Gametic formulae	Character of awns
<i>Hordeum spontaneum</i>	22	AA VV UU	} long
H ₄₀	15.6	{ AA VV uu	
H ₁₃	14.5		
H ₉	12.87	{ AA vv U U	
H ₄	12.70		
H ₆	12.49		
H ₁₀	12.36		
H ₁₁	11.00	AA vv uu	} short
H ₃₄	4.3	aa vv UU	
H ₃₇	2.5	aa VV uu	

HOOD (1). — From the ratio *awn with hood* : *awn without hood* = 9 : 7, it appears that 2 factors must influence the formation of the hood, and from the ratio *hood + long awn* : *short awn* 12 : 4 it results that one of them is identified by the determinant A (length of awn). There are thus 2 factors, K and A. In the crossing experiments, and the detailed study of the transmission of this character, numerous irregularities are observed which, in the opinion of the writer, are attributable to the factor of length of awn, whereas the factor K would behave perfectly normally. It is not possible to say if we have here to do with a special factor distinct from A, and capable of influencing the length of the awn or of modifications to which A may be subject owing to unknown causes. In any case, the writer distinguishes 2 factors for length: A' and A. There are 2 distinct cases.

1) The two factors K and A' are necessary for the formation of the hood :

Long awns with hood	KK A' A'
Long awns without hood	kk A' A'
Short awns without hood	KK a' a' or kk a' a'

2) The factor K may suffice for the formation of the hood :

Short awns without hood	KK AA and KK aa
Long awns with hood	kk AA
Short awns without hood	kk aa

In the first case, we shall have in F_2 the ratio 9 : 7 ; in the second, the ratio 3 : 1 (awn with hood : awn without hood).

PHENOMENA OF ATTRACTION BETWEEN CERTAIN FACTORS. — In the course of his researches, the writer has been able to observe and study a series of phenomena which throw a new light upon the interesting problem

(1) The glumes are detached at the base, and are carried upwards to the extremity of the developing awns. The awn is thus covered by a species of hood. This phenomenon is of frequent occurrence in some Asiatic barleys (*Ed.*)

of the attraction of factors called coupling in English and *Koppelung* in German.

L = factor determining the character "thinness of ear"

A = factor determining "elongated awn"

From H_{27} (II AA) \times H_{10} (LL aa) was obtained in the F_1 generation the hybrid LI Aa, capable of forming 4 kinds of gametes: LA — La — aL — lA which in combination should give in F_2 : I) individuals with thin ears and long awns — II) individuals with dense ears and long awns — III) individuals with thin ears and short awns — IV) individuals with dense ears and short awns — in the proportion 9 : 3 : 3 : 1.

On the other hand, the following values were obtained in the 2 cases analysed. —

	I	II	III	IV
1) Out of 1600 individuals of F_2 generation	1083	192	117	208
2) Out of 2304 individuals of F_2 generation	1585	251	142	325

But according to the ratio 9 : 3 : 3 : 1, the figures should be :—

	I	II	III	IV
1) Out of 1600 individuals of F_2 generation	900	300	300	100
2) Out of 2304 individuals of F_2 generation	1296	432	432	144

There are, therefore, too many thin-eared, long-awned individuals, and also too many dense-eared, short-awned individuals while there are too few individuals with dense ears and long awns and with thin ears and short awns (contrasting characters of length).

These ratios are satisfactorily explained by the theory of attraction between certain factors: in the case studied, by the attraction existing between L and A, which causes them to unite to form the gamete LA.

The hybrid LI Aa, instead of producing an equal number of the 4 kinds of gametes, LA — lA — aL — al, produces by means of the attraction existing between A and L, a number of gametes LA (and consequently also al) larger than the calculated number, and to the detriment of the gametes lA and aL, which thus are proportionally far fewer in number.

The two series of the F_2 generation —

1083	192	117	208
1585	251	142	325

are explained by the following ratios of the gametes :—

$$\begin{aligned} 4 \text{ LA} : 1 \text{ lA} : 1 \text{ lA} : 1 \text{ aL} \\ 5 \text{ LA} : 1 \text{ lA} : 1 \text{ lA} : 1 \text{ aL} \end{aligned}$$

Similar instances of attraction are also observed between M (a factor determining a "thin ear") and V (the factor determining the want of length in the awns); in this case, the correlation is even absolute :—

$$M V : m V : M v : m v \quad \infty : 1 : 1 : \infty$$

LENGTH OF CULM. — As regards this character, there appear to be forces at work analogous to those found influencing the density of the ear. There seems to be 1 principal factor H and 2 secondary factors I > J and the following gametic formulæ should be obtained :—

II 34	h h I I J J
II 37	h h I I j j
II 9, 10, 11, 20	H H I I
II 27	H H I I
H 40	H H I I j j
<i>Hordeum spontaneum</i>	H H I I

CORRELATIONS BETWEEN LENGTH OF CULM AND LENGTH OF AWN, AND BETWEEN LENGTH OF CULM AND DENSITY OF EAR. — In examining for length of awn, density of ear and length of culm the numerous descendants in the F_2 and F_3 generations of the crosses between different lines of barley, the writer found that many forms which could theoretically have been expected, according to the law of the re-combination of characters, were not produced; there was each time a fixed and small number of forms that only represent some of the possible combinations. These preliminary remarks will serve in the first place to explain this phenomenon :—

Factors for length of awn	A, V, U.
" " density of ear	L, M, N.
" " length of culm	H, I, J

According to what has been said above, we have the following schemes of association :—

I) A L : A l : a L : a l	5 : 1 : 1 : 5
II) M V : M v : m V : m v	∞ : 1 : 1 : ∞

now, admitting that :—

III) A H : A h : a H : a h	$= \infty : 1 : 1 : \infty$
IV) V I : V i : v I : v i	$= \infty : 1 : 1 : \infty$

it follows that :—

V) L H : L h : l H : l h	5 : 1 : 1 : 5
VI) M I : M i : m I : m i	$= \infty : 1 : 1 : \infty$

Taking the most simple case :—

$$H_{34} \times H_{37} \quad II \, mm \, nn \, aa \, vv \, UU \, hh \, II \, JJ \times II \, MM \, nn \, aa \, VV \, uu \, hh \, II \, jj$$

Here, only the associations II, IV, VI, play any part, and of these II and VI do not need analysis since the II plants all, without exception, have compact ears. There only remains $VI : Vi : vi : vi = \infty : 1 : 1 : \infty$ where the sign ∞ denotes that VI and vi are formed with the same frequency ∞ relatively to the gametes vi and VI of which the appearance is, however, excluded.

As is shown by the section on *length of awns*, from aa Vv Uu are obtained in the F_2 generation, individuals with an average length of awn (*halb-*

lang), and individuals with short awns, according to the ratio 9 : 7. U is transmitted independently of other factors, whereas V and I are transmitted together ; thus we shall have :—

UUVVll	long awns and tall culms
2 UUVvll	" " " "
Uu vv ll	short awns and short culms
2 Uu VV ll	long awns and tall culms
4 Uu vv ll	" " " "
2 Uu vv ll	short awns and short culms
uu VV ll	" " tall "
2 uu Vv ll	" " " "
uu vv ll	short awns and short culms

The summary of this is :—

- 1) Individuals with long awns and tall culms = 9
- 2) " " short " " " " = 3
- 3) " " long " " " short = 0
- 4) " " short " " " " = 1

This explains how in the case investigated by the writer (as is shown by the correlation table), the group of individuals with long awns and short culms is non-existent, whereas there are 366 individuals with long awns and tall culms, 141 with short awns and tall culms, and 116 with short awns and short culms, and that in the predicted ratio 9 : 3 : 4.

Similar explanations apply to other cases which, owing to the increase in the number of factors, are more complex.

DENTICULATION OF GLUMES. — Teeth varying greatly in number and size are formed according to the veins of the glumes. From his crossing experiments, and his examination of the hybrids, the writer has been able to determine 2 factors **G** and **G'**, the action of the first being clearly predominant. The phenomena of the attraction and repulsion of the determinants producing teeth and the number of rows are extremely interesting. The reader will remember that the determinant for the 2 rows is known as **Z** (+**W**). There would appear to be a repulsion between **Z** and **G**, whereas, on the contrary, a strong attraction exists between **Z** and **g** on the one hand, and **z** and **G** on the other. Hence there arises an excess of toothed 6-rowed individuals and of smooth, 2 rowed individuals, while there is an insufficient number of toothed, 2 rowed individuals, and of smooth, 6 rowed individuals, so that instead of the ratio 9 : 3 : 3 : 1, there are in the F_2 generation, very different values. The hybrid F_1 , with the formula **Zz Gg**, instead of forming an equal number of the 4 types of gametes **ZG** — **Zg** — **zG** — **zg**, produces a number of **Zg** (and of **zG**) 5 times greater than the number of **ZG** (**zg**).

$$1 \text{ } ZG : 5 \text{ } zG : 5 \text{ } Zg : 1 \text{ } zg$$

The analytical data confirm the exactness of the scheme.

NAKED AND COVERED GRAINS. — In the latter, the glumes adhere to the grains, whereas in the former, they do not. The adherence of the glumes appears to be due to a single factor **S**, whose influence can be greatly modified by external agents.

Gametic formulae of the barleys studied.

Kinds of barley	Brittle rachis	Density of ear	Number of rows	Length of awn	Hood	Height of culm	Denticu- lation		Colour of glumes	Basal tuft of hairs	Paleae of the caryopses
<i>Hordeum spontaneum</i> . .	BB RR	LL MM NN	ZZ WW	AA VV UU	kk	HH II	GG	G'G'	ff	DD	SS
H ₃ Manchuria, . . .	BB rr	LL	zz ww	AA	"	HH	GG	gg	"	"	"
H ₄ Chevalier . . .	bb RR	LL mm NN	ZZ WW	AA vv uu	"	"	gg	g'g'	"	dd	"
H ₆ Hofbrau	"	"	"	"	"	"	"	"	"	DD	"
H ₉ Norwegian	"	"	zz ww	"	"	HH II	GG	g'g'	"	dd	"
H ₁₀ Samarie . . .	BB rr	"	ZZ WW	"	"	"	"	"	"	"	"
H ₁₁ do	"	"	zz ww	AA vv uu	"	"	"	"	"	DD	"
H ₁₃ Black Algerian .	bb RR	"	"	AA VV uu	"	HH	"	"	FF	dd	"
H ₁₅ 4-rowed Nepal . . .	BB rr	LL mm nn	"	AA	KK	"	GG	G'G'	ff	DD	ss
H ₂₀ do	"	"	"	"	"	HH II	gg	G'G'	"	"	"
H ₂₃ 2-rowed Nepal . .	bb RR	LL	ZZ WW	"	"	HH	gg	g'g'	"	"	"
H ₂₇ do	"	LL MM nn	"	"	"	HH II	"	"	"	"	"
H ₂₉ do	"	LL mm NN	"	"	"	"	gg	G'G'	"	"	"
H ₃₄ Sekitori (Japan) .	BB rr	ll mm nn	zz ww	aa vv uu	kk	hh II JJ	GG	G'G'	"	"	SS
H ₃₇ Santoku (Japan) .	"	ll MM nn	"	aa vv uu	"	hh II	"	"	"	"	"
H ₄₀ Naked awned . . .	"	LL MM nn	ZZ WW	AA VV uu	"	HH II JJ	CG	g'g'	"	"	ss

COLOUR OF GLUMES. — The glumes may be light coloured (from white to yellow) or dark (from violet to black). The difference between the two types is probably to be attributed to the presence, or absence, of a single factor **F**, which produces a tannic colouring pigment. In the 2nd generation, the ratio between pigmented and non-pigmented is 3 : 1.

BASAL TUFT OF HAIRS. This tuft is found at the base of the grain on the inner side, between the cuticles. There are two types: the Chevalier type, in which the hairs are ramified, and the native (*Landform*), in which the hairs are straight. The two types are distinguished by the presence, or absence, of a single dominant factor **D**, which determines the native form.

With the help of all the collected material, the gametic formulae were drawn up which are given in the accompanying table (page III2).

1119 - Relation between Yield and Ear Characters in Maize. — HUTCHESON, C. B. and WOLFE, T. K., in *Journal of the American Society of Agronomy*, Vol. X, No. 6, pp. 250-255, Bibliography of 10 works. Washington, D. C., September 21, 1918.

In recent years some doubt has arisen as to the value of certain score-card points as a criterion for selecting high-yielding strains of maize. The question is, do the points emphasised on the score card have any relation to the yielding capacity of the individuals possessing these characters? Considerable work has been done along this line, some of which is briefly reviewed by the writers (1). The data in this paper deal with the relation between yield and ear characters of the progeny of certain seed ears selected at random. The results are summarized in the annexed table.

(1) In extensive experiments conducted at the Ohio station (WILLIAMS, C. G. and WELTON, I. A., Corn Experiments, *Ohio Agricultural Experiment Station Bulletin* 282, 1915), it was found that there was no mutual relationship between various seed ear characters and yield.

II. H. LOVE (The Relation of Certain Ear Characters to Yield in Corn, *Proceedings of the American Breeders' Association* Vol. VII, Pp. 29-40, 1912) obtained a slight increase in yield from planting long ears and from planting heavy ears. However, such seed ear characters as numbers of rows, average weight of kernel, and ratio of tip to butt did not have any marked effect on yield.

II. H. LOVE and J. B. WENZ (Correlations between Ear Characters and Yield in Corn, *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 315-322, 1917) studied the relation of such seed ear characters as length, average circumference, average cob circumference, weight of ear, number of rows, average weight, average length, average width of kernels, and percentage of grain to yield. The average circumference of the seed ear was the only character which showed any significant relation to yield. The writers conclude that "the only basis left for selecting high yielding seed corn is the ear-to-row progeny test."

C. F. HARTLEY (Progress in Methods of producing higher yielding Strains of Corn, *U. S. Dept. Agr. Yearbook* for 1909, pp. 309-320, 1910) studying four varieties of corn over a period of six years, in which more than 1000 ear-to-row tests of production were made, obtained results indicating that no visible characters of apparently good seed ears are indicative of high yielding capacity.

R. PEARL and F. M. SURFACE, (Experiments in Breeding Sweet Corn, *Annual Report of the Maine Agricultural Experiment Station*, pp. 249-307, 1910), in a two years ear-to-row test, found that there was no evidence of any close association or correlation between the size and conformation of the seed ear and the yield of corn obtained from it on planting.

Relation between yield and various ear characters of the progeny of different ears of Boone County White maize planted in the ear-to-row test at the Virginia station in 1916 and 1917.

Characters	High yielding strains		Low yielding strains		Average	
	1916	1917	1916	1917	1916	1917
Average length in.	8.61	8.31	8.30	7.65	8.46	7.98
Average circumference "	6.90	6.70	6.69	6.46	6.80	6.57
Ratio of tip to butt circumference	.85	.88	.84	.87	.86	.86
Average circumference of cob . . in.	4.09	4.29	3.97	4.08	4.19	4.03
Yield bushels per acre	82.74	62.30	61.97	47.58	72.52	54.78
Percentage of grain	85.27	79.46	83.97	80.57	82.37	82.27
Average number of rows	16.77	16.51	16.57	16.35	16.64	16.46
Average length of kernels . . . in.	.45	.38	.43	.38	.42	.41
Uniformity of exhibit %	55.00	49.44	48.00	48.18	52.22	48.09
Shape of ear and trueness of type .	55.42	41.67	50.50	38.64	48.55	44.57
Character of tips	60.83	26.11	47.00	25.50	43.47	36.25
Character of butts	59.17	39.44	55.00	40.91	49.31	47.96
Uniformity of kernel	55.83	43.89	56.00	35.45	49.86	45.73
Shape of kernels and size of germ .	64.58	40.56	53.50	40.45	52.27	46.98
Space between kernels	71.25	53.33	71.50	52.27	62.20	61.89
Space between rows	69.58	45.56	65.60	52.73	57.57	58.87

From these results the following conclusions are arrived at: — (1) The relation between yield and length, average circumference of cob, uniformity of exhibit, shape of ears and trueness to type, character of tips, uniformity of kernels, and shape of kernels and size of germ is significant. (2) The relation between yield and ratio of butt to tip circumference, percentage of grain, number of rows, average length of kernels, character of butts, space between kernels, and space between rows is small. (3) The points emphasised on the score card are of value

A. C. MACCALL and C. S. WHFELER (Ear Characters not correlated with Yield in Corn, *Journal of the American Society of Agronomy*, Vol. 5, No. 2, pp. 117-118, 1913), found that neither length, weight, nor density or ear is correlated with yield.

H. J. SCONCE (Scientific Corn Breeding, *Proceedings of the American Breeders' Association*; Vol. 7, pp. 43-50, 1911) in studying the relation between various seed ear characters to yield in the Reid Yellow Dent and Johnson County White varieties, found that ears containing 18 or 20 rows gave the highest yield. In Reid Yellow Dent, small-germ kernels gave the best results, but the large-germ kernels of Johnson County White gave the highest yield. The relation of shape of kernel and yield is striking in both varieties used. The writer states: "The kernel of ideal shape, which tapers slightly and has the square shoulders and full tip, has been giving the best results. Not once since beginning the experiment has an ill-shaped kernel on the average outyielded the ideally shaped kernel".

A. G. MONTGOMERY (Experiments with Corn, *Nebraska Agricultural Experiment Station Bulletin*, 112, 1909), found that the long, smooth type of seed ears outyielded the standard type ears. Also, extra large ears are no more valuable than medium-sized ears for seed purposes.

in selecting high-yielding strains of maize. (4) High-yielding strains of maize are high-scoring strains.

1120 - Description of Two New Kinds of Maize obtained at Rieti, Italy: "Saverio Strampelli" and "Elena". — STRAMPELLI, N., in *L'Italia agricola*, Year 56, No. 6, pp. 175-177, 2 figs. 1 pl. Piacenza, June, 1919

"SAVERIO STRAMPELLI" MAIZE = Type 2 a. a./l. of the hybrid *Magengo* (of Rieti) \times *Jaune précoce d'Ausonic*.

Culms. — Total height: about 1.40 m; height at point of the insertion of the lamina on the sheath of the last leaf about 1 m.; insertion of lower male inflorescence at about 0.30 m.

Male inflorescence. — The top branch is more developed than the others, which are placed in decreasing order of length, so that the lowest are the longest.

Female inflorescences. — To the number of 2; conico-cylindrical; length about 16 cm.; diameter at middle of height: 4.4 cm.

Caryopses. — Very dense, rather wide and long, nearly discoidal, of a fine yellow colour, transparent, glutinous, farinaceous, embryonic zone yellowish-white, long and full.

Rachis. — Slightly reddish, measuring hardly 1.3 cm. in diameter.

Average yield, over 4 years, at Rieti: 51 quintals per ha., with a maximum of 70 quintals in years without drought. In spite of the dry weather in 1918, the yield in the experiment field of the Royal Station of Agricultural Chemistry in Rome was over 38 quintals per hectare.

Date of ripening. — At Rieti, 115 to 120 days after sowing.

"ELENA" MAIZE — Type I₃ of the hybrid *Quindici Agosto* \times *Pignoletto*

Culms. — Total height about 1.80 m; height at the point of insertion of the lamina on the sheath of the last leaf about 1.50 m, height of the point of insertion of the lower ear 0.75 m.

Leaves. — Abundant with very large blades.

Male inflorescence. — Well supplied with numerous thickly-set branches.

In an experiment conducted at the Iowa station H. B. HUGHES (An interesting Seed Corn Experiment, *Iowa Agric*, Vol. 17, No. 9, pp. 421, 425, 418; 1917; Abstracts in *Experiment Station Record*, Vol. 37, 830, 1918), 500 ears of corn were secured from the field without any selection and scored by twenty five judges. A portion of each ear was planted in the field; the first year's result indicated that the ears receiving the highest scores were also the most productive in the field. As compared with the bulk of the ears, the fifty best ears, as selected by the majority of the judges, yielded on the average 5 bushels more to the acre.

Experiments conducted by C. C. CUNNINGHAM (The Relation of Ear Characters of Corn to Yield, *Journal of the American Society of Agronomy*, Vol. 8, No. 3, pp. 188-196, 1916) indicate that the length of ear has little relation to yield, but that varieties differ in this respect. The indications are that slender seed ears are more productive than those of comparatively large circumference. There was apparently no relation between the character of tips and butts and percentage of grain to cob to yield. It was found that ears of intermediate indentation outyielded smooth or rough ears, while the rough consistently yielded lower than the smooth ears. The relation of number of rows to yield varied with different varieties

(The Authors)

Female inflorescences. — There are 2, 3, and sometimes 4 fertile female inflorescences on each culm. They are about 15 cm. long and 4 cm. in diameter. Stigmata red.

Caryopses. — Very close together, rather small, cuneiform (exterior flattened) colour orange-yellow, transparent, glutinous, embryonic zone yellowish-white, average development.

Rachis. — Reddish-white, ligneous zone much reduced, medullary zone large, diameter 1.10 cm.

Yield. — Average over 4 years, 45 quintals per hectare, with a maximum of 54 quintals and a minimum of 35 quintals.

Date of ripening. — At Rieti, 120 to 125 days after sowing.

1121 — **Some Experiments on Growing Maize in England.** — PUNNETT, R. C., in *The Gardeners' Chronicle*, Vol. LXV, No. 4072, pp. 13-14, 1 fig. London, January 11, 1919.

Maize is often grown in England either as fodder or as vegetable produce. In the former case, tall luxuriantly-growing varieties are used in which the cob never ripens in that climate; in the latter case one has the choice of several of the early varieties of sugar maize, principally those which have lately been improved by the American breeder. The recent scarcity of poultry food has induced some people to attempt maize cultivation on a small scale for the sake of the ripe grain, a purpose for which a flint or a dent maize is required. The only variety suitable for this is Sutton's Quarantain, a dwarf form of Yellow Flint. It ripens very well but the cob is a tiny one and the yield is low.

Some years ago Professor BIFFEN at the Institute of Genetics in Cambridge, investigated the possibilities of growing maize as a grain crop in England, using for the purpose some early varieties. Among these were two kinds called Gehu and Eighty-day White which crossed freely in growing and the mixture of which was subsequently sown. Prof. BIFFEN was unable to continue the experiment, but in 1914 he gave the writer a few cobs and the latter grew them for three years, choosing for seed each time the earliest and largest cobs. In 1917, the yield of grain was at the rate of 39 bushels per acre.

Of the original parents of the maize one was yellow and one white, and in the resulting hybrid the yellow cobs greatly predominated. No selection was made as regards colour, but in 1918 the writer selected a certain amount of white seed and sowed this apart from the rest, which was mostly yellow. The white gave a yield at the rate of over 61 bushels per acre, while the yellow gave at the rate of about 47 bushels per acre, in spite of a most unfavourable season.

For purposes of comparison, the writer sowed in 1918 four varieties of the early sweet corns grown in America.—Catawba, Golden Bantam, Extra Early Cory, and Howling Mob. None of these sugar maizes ripened so early as the flint when all were grown under similar conditions, and the yield in bushels per acre was as follows: Golden Bantam 12.7, Howling Mob 13.4, Catawba 20.9, Extra Early Cory 25.2, Yellow Flint 41.8.

In comparison with southern countries the new maize stands high as regards composition, as it contains 10.5 % protein and 5.2 % oil.

The writer estimates that maize is one of the cereal crops most suited to the small holder who wishes to grow a few sacks of grain for feeding to poultry or pigs.

1122 - **Improvement of Cotton by Pure Line Selection in British India.** — BURT, B. C. and HAIDER, N., in *Bulletin No 88, Agricultural Research Institute, Pusa*, pp. 1-32, 1 fig., 10 pl. Calcutta, 1919.

Results of a series of experiments in the improvement of the acclimatised American cotton known as Cawnpore-American by pure line selection, during the period 1913-1917, at the Kalianpur Seed Farm, with the object of isolating superior types for uniformity of lint and ginning percentage.

The characters to which attention was paid were branching habit, hairiness of the leaf, colour of the stamens, ginning percentage, length and fineness of the lint, shape and size of boll and, to a less extent, the leaf shape, stem colour and colour of the foliage.

BRANCHING HABIT. — The type of branching habit is closely related to the length of the vegetative period, and is of special importance in the United Provinces (Central and North India), where the short growing season for cotton renders it necessary to use as early varieties as possible. The various types of plants found in Cawnpore-American ranged in branching habit from the extreme sympodial type with only secondary fruiting branches to a late flowering monopodial type with numerous limbs and producing only a few flowering branches from the main stem at the top. Between these two extremes a complete range of intermediates occur and races have been isolated which are constant in regard to both the extreme types and the intermediate ones. The development of accessory buds on the stem, even when they give rise to flowering branches, is always undesirable as it interferes with the setting of earlier flowers. Here also, varieties have been isolated where the character in question appears in less degree; there are varieties almost without accessory buds and others where the great development of the buds tends to mark the habit of the plant.

LENGTH OF INTERNODES AND CHARACTER OF THE SECONDARY FRUITING BRANCHES. — These two characters are closely associated. Plants with long internodes are usually straggling in general habit and tend to produce long weak branches, the lower ones of which are apt to trail on the ground.

Generally speaking, the best type for Cawnpore conditions appears to be a compact plant producing three or four limbs (secondary non-flowering branches) near the base of the main stem and with secondary flowering branches starting early, moderately short internodes and stout branches.

ROOT SYSTEM. — In the course of the work it was found that some races of Cawnpore-American cotton are fairly satisfactory as regards lint quality and as short in vegetative period as native *desi* cotton. These sorts, however, turn out very badly if sown late, and an examination of the root system is sufficient to explain this clearly.

When sown with irrigation early enough for the plants to reach a height of 9 in. or more before the burst of the monsoon, both classes of cottons developed strong root systems rooting down to at least 4 in. comparatively rapidly. When sown later, but still before the monsoon, both types still succeeded in establishing themselves, though the rooting of the American was less vigorous and the plant less thrifty. When sown in more or less saturated land after the advent of the monsoon, the rooting in both cases was dwarfed, but while the *desi* cottons still developed fair healthy roots and were able to establish themselves, the roots of the American were short and poorly developed and the plants stunted.

HAIRINESS OF THE LEAF. -- Plants with smooth leaves are easily attacked by aphids. The Cawnpore-American has its leaves generally well covered with hair. All races with leaves not fully hairy should be discarded.

GINNING PERCENTAGE. -- The Cawnpore-American gins from 2 to 3 per cent. below *desi* cotton. It is possible to obtain by selection races with a high average ginning percentage.

LINT QUALITY. -- A constant fault of Cawnpore-American is the variation in the staple, due to several causes: -- (1) the presence of races with short and rough fibre, which should be isolated and discarded; one at least of these families is recognisable by its vegetative characters and can easily be eliminated; (2) the presence of late flowering types which did not mature their lint well by harvest time.

The elimination of late and short-fibred races will lead to a progressive improvement in the type.

The work of pure line selection, begun in 1912, has resulted in the isolation and fixation of a certain number of lines which may be subdivided into 5 groups as regards their agricultural characters:

I. -- *Very early*: Ca, 10, 11 and 28. These are all characterised by extremely small development of the limbs. They are in heavy flower within 54 days of sowing, depend for their yield almost entirely on the secondary fruiting branches, and are the nearest approach in habit to the local *desi* cotton that occurs among the Americans. Numbers 10 and 11 have characteristic red stems, comparatively short internodes and small bolls. Number 28 has somewhat larger bolls, but as it is not fully rough-leaved, and an attempt to obtain by re-selection from it a race with fully hairy leaf having failed, it has now been discarded.

II. -- *Early*: Ca 5. This type is distinct from those described above. The plant is low and bushy; good limbs to the number of three or four are readily developed; and the plant is extremely prolific and sets its bolls well under comparatively unfavourable conditions. The yield is largely dependent on the secondary fruiting branches, but the tertiary fruiting branches also contribute largely. The boll is large and pointed; the flowers have golden yellow anthers. The plant is in full flower in about 64-69 days from sowing. The secondary fruiting branches are stout and the internodes medium short.

III. -- Ca 7 and Ca 9. This type flowers a week later than Ca 5,

with slightly longer vegetative period, branches larger, internodes longer, boll pointed. The development of tertiary fruiting branches is early enough to add materially to the late yield.

IV. — *Medium late group*: Ca 1, 3, 23 and 26. These flower about 70 days after sowing. Though the number of limbs rarely exceeds 4 or 5 and the first secondary branch appears low on the main stem the plants of this group develop large strong limbs, and the result in a wet season is the partial suppression of the earlier fruiting branches. In some years, these families have yielded well, but as a considerable portion of the crop is dependent on the tertiary flowering branches, late sowing or an unfavourable season might result in a very poor yield.

V. — *Late*. Ca 15, 1 and 18. There is a little doubt about the position of 15 and 1 in this grouping. Ca 18 is undoubtedly a later type, flowering 78 days after sowing, and just on the limit for successful growing at Cawnpore. It has a good development of fruiting secondary branches though comparatively late; the tertiary ones do not develop in time for the bolls to open well except in dry years.

During selection work, later types have been isolated which will have to be discarded. Comparative growth trials were carried out to see which of the above lines should be preferred. In spite of unsuitable weather during the testing period, the data collected tend to show the superiority of the families 5 (group II), 7 and 9 (group III) which would be most adapted to average conditions. Early types suffer from the bolls falling during the rainy season, while late types do not ripen in time. In any case the quality and quantity of the product are superior to those of mixed origin, and as this is a confirmation of the positive results obtained by selection, the way is open to new improvements.

1123 — **Improvement of Cotton in the South of British India.** — See No 1139 of this Review.

1124 — **Improvement of Sea Island Cotton in the Lesser Antilles.** — HARLAND, S. C. in *West Indian Bulletin*, Vol. XVIII, No. 3, pp. 145-161. Bridgetown, Barbados, 1919.

Since 1903, Sea Island cotton in the different islands of the Lesser Antilles has been the subject of experiments to improve the quality of the lint and find varieties of cotton suited to the conditions special to each district. Thus, at St. Vincent, the aim was to breed varieties with a specific high yield and able to resist the fungoid diseases which greatly diminished the yield of cotton every year. Formerly, the cottons from Montserrat were in little favour on the market on account of their coarse lint. Mr. ROBSON has just shown that cotton of very fine quality can be grown also in these islands. Again, in Antigua the aim has been not only improvement in lint, but also the production of types likely to thrive on the heavy tenacious land of the island.

The article in question shows the results of a series of experiments in selecting on Sea Island cotton in the Lesser Antilles.

In the study of a character related to yield (e. g. the weight of lint per seed) the writer began by making a large number of analyses and in-

5) Improvement during many years led to the isolation and elimination of low yielding lines (34-36 mgm. for the families B. S. NN. 1.33; 1.53; 5; and 6) by concentrating on more improved crosses led ultimately to the isolation of the best lines.

NUMBER OF CELLS PER BOLL — In this connection it has already been pointed out that attempts should be made to improve types having a high percentage of 4-cell bolls. The Sea Island variety may have 3, 4 or 5 cells. In some plants there are bolls with 3, 4 or 5 cells, in others the bolls have only 3 or 4 cells, in general, the relation between the 3 or 2 types of boll for each plant tends to be constant.

Families	Aver no of seed per cell	Aver wt of lint per seed gm	Aver no of cells per boll	Wt of lint per boll gm
V 1 9. 7.	5 9	44	3 3	0 86
V 1 9 19	6 0	19	3 6	1 06
V. 1. 9 22	5 7	47	3 6	0 96
V 1. 9 27	5 9	42	3 6	0 89
V 1. 9 35	5 8	46	3 7	0 99
V 1. 9 37	6 0	45	3 7	1 00
V 5 6. 18.	5 7	43	3 3	0 61
V 5 61. 24.	5 6	46	3 2	0 82
V 5 61. R	6 0	15	3 2	0 86
V 5 56 33	6 0	16	3 3	0 91
V 5 56. 34	6 3	17	3 3	0 98
V 3. 3 3	5 5	50	3 2	0 68
B S 1. 33	5 8	36	3 2	0 67
B S. 1. 53	6 1	35	2 2	0 65
13 1 3. 1. 16	4 8	47	3 2	0 72
13. 43 1 20	5 1	45	3 2	0 73
Common Sea Island	5 8	44	3 1	0 79

The average values for particular lines keep constant even under different climatic conditions, hence it is a hereditary character and, consequently, is susceptible of selection. In experiments towards this end, the results obtained were clearly positive.

1) Two types have been distinguished in Sea Island, differing in average number of cells per boll, viz 3.2 to 3.3 in one, and 3.6 to 3.7 in the other.

2) The families V 1 9 37 and V. 1. 9 35 may be considered as having a high value as regards percentage of many-celled bolls; on the other hand the families V. 1. 9 7, 13 43. 18 and 13 43. 20 behave like pure lines with very low values.

3) The most striking result shows that, by means of selection the percentage of 4-cell bolls has been raised from 20 (average value for ordinary Sea Island) to 60-70.

COMPARATIVE VALUE OF DIFFERENT LINES — After discussing the

morphological characters more or less in correlation to yield, the writer collects in the annexed table the data on the principal families improved up to the present.

By the methods of selection used by the writer, lines of Sea Island have been isolated with a weight of lint per boll 31 % above that of the common type.

This is the case for the line V.1.9.19 with 1.06 gm. against 0.79 gm., the average value for the common type.

1125 - Giantism in *Nicotiana Tabacum*; Investigations in the United States. —

ALLARD, H. A., in *The American Naturalist*, Vol. LIII, No. 626, pp. 218-233, 5 tab., bibliography of 8 publications. Lancaster, Pa., May-June, 1919.

Among different varieties of tobacco grown in the United States (Sumatra, Maryland, Cuban and Connecticut Havana types), several times there has been recorded the sudden appearance of giant plants, with greatly elongated main stems and a great increase in the number of leaves. Their period of vegetative growth is of such long duration that blossoming does not normally take place in the field. To obtain seed from them, they are transplanted to the greenhouse in autumn, where vegetative growth is resumed with the final production of normal blossoms and seed during winter.

The appearance of these giant plants has been observed especially :—

1) *In pure lines of normal tobaccos* : thus the type Broad-leaf Mammoth was first observed in 1906 in a pure line of Maryland Broadleaf.

2) *In descendants of crosses between normal types* : thus the type Narrowleaf Mammoth appeared in 1907 in F_2 plants of a cross between a Broadleaf type and a Narrowleaf type of Maryland tobacco.

BEHAVIOUR OF GIANTISM IN CROSSES. — Since Mammoth forms are now grown commercially in the United States and promise to become valuable new varieties, it has been considered desirable to determine the possibility of combining the Mammoth character of indeterminate growth or giantism with other characters of commercial value by crossing Mammoth types with ordinary varieties.

Thus, the Maryland Narrowleaf Mammoth has been crossed with a number of pure lines of the best varieties, including White Burley, Yellow Pryor, Little Oronoco, Connecticut Broadleaf, etc.

First generation plants blossomed in practically the same period required by the ordinary varieties. They are, however, usually somewhat taller and produce a somewhat higher leaf number than the ordinary varieties, thus showing more or less intermediate conditions between the normal and the Mammoth parents.

On the other hand, the F_2 of the cross Mammoth Burley ♀ × White Burley ♂ gave 638 plants, of which 158 were of the giant type. This is a very close approximation to the theoretical Mendelian ratio of 3 : 1. From these and other data it would appear that the Mammoth character is recessive.

ORIGIN OF MAMMOTH TYPE IN A LINE DESCENDING FROM A HYBRID

SPECIES. — It has already been mentioned that the Maryland Narrowleaf Mammoth and a Burley Mammoth appeared in the F_2 generation of certain crosses. In the author's experience giant plants of the Narrowleaf type appeared in the F_2 of the cross Broadleaf Maryland \times Narrowleaf Maryland.

In 1914, the blossoms of a F_1 plant of the cross Connecticut Broadleaf (pink) $\varnothing \times$ Giant Red flowering (carmine) ♂ were pollinated with the pollen of *Nicotiana sylvestris* (white), and gave a large number of fertile seeds, although F_1 plants of crosses between *N. tabacum* and *N. sylvestris* are generally sterile.

In the F_2 there was a notable segregation into plants with pink, white and carmine blossoms of variable size and shape and showing various anomalies. From the carmine blossom plants two, Nos. 9 and 12, were selected for further Mendelian studies.

In the F_3 the plant No. 9 proved to be heterozygous, breaking up into carmines and pinks, approximating to the theoretical ratio of three carmines to one pink, all normal in size and habit of growth. The plant No. 12 was homozygous for carmine but its progeny was very variable in height and number of leaves, and fell into 3 groups: (1) short plants of 20–25 leaves, first to blossom; (2) plants of intermediate height, 35–40 leaves, blossoming later; (3) plants of Mammoth habit of growth, over 40 leaves, not blossoming.

Two of these Mammoth plants (Nos. 12a and 12b) each seven feet high, were transplanted in the greenhouse on October 21 and produced on December 8 carmine blossoms. Plant No. 12a produced 70–75 leaves; No. 12b produced 60–65. In addition to these two Mammoth plants, the seed of several of the taller sister plants, Nos. 12c and 12d in class 2 (medium height, 35–40 leaves, late blossoming) were saved separately. The progenies of all were grown in the field, with the following results in F_4 —

No. 12a progeny 60 plants, all Mammoth type, with average height seven to seven and a half feet.

No. 12b progeny 60 plants, all Mammoth type, but not quite so tall as in 12a (6 $\frac{1}{2}$ –7 feet).

No. 12c progeny 40 plants, of which 14 possessed Mammoth characteristic, non-blossoming.

No. 12d progeny 48 plants, of which 2 Mammoth, non-blossoming.

Hence plant No. 12 produced (1) Mammoth types, non-blossoming and breeding true, (2) intermediate inconstant types, behaving as hybrid forms and giving rise in the progeny to a certain percentage of typical Mammoth non-blossoming types.

PROBABLE CAUSES OF GIGANTISM. These seem to consist in modifications affecting directly or indirectly the gametes.

When both gametes are affected it should be expected that a Mammoth plant will result which will breed true.

When only one gamete is affected a progeny of hybrid character will result which will give mixed progeny.

Where a Mammoth plant appears alone among progeny of a normal plant, it may be admitted that the modification would have directly affected the gametes.

Again, it is far more difficult to explain the case of a normal plant with several progeny or even all having Mammoth characteristics. It seems hazardous to admit a modification affecting at the same time all the gametes, or at least a great part of them, but the assumption might be made of a change taking place at some stage previous to the development of the gametes themselves. Thus, should the change take place in a mother cell of the anther preceding tetrad formation, it is reasonable to suppose that the four resulting pollen grains may also bear the Mammoth character. It is possible, however, that the change may take place very much earlier, so that a part or even all the sporogenous cells will be affected. If these conditions occurred, it is easy to see how great numbers or even all the pollen grains arising from their division would bear the Mammoth character. Since the development of the megasporangium is in every way parallel to the development of the microsporangium or anther, similar changes would affect one or more egg-cells, depending on whether the change responsible for Mammoth character took place immediately in the egg-cell itself, in the mother cells, or very much earlier.

1126 - Characteristics of the Cross Dwerghoorn \times Kanari as compared with those of other Types of Tobacco in Java. — D'ANGREMOND, A., in *Proefstation voor Vorstlandsche Tabak, Mededeeling*, No XXXIII, pp. 69-85 Samarang, 1918

Types of tobacco studied — Y10, E1 and Dwerghoorn \times Kanari. The following is a summary of the results of the observations and experiments on the yield per plant and chemical composition.

(1) In yield per plant Y10, E1 and Dwerghoorn \times Kanari are equal; the slight differences are counterbalanced by average error. The yield of the different types is expressed as the weight in grammes of dried leaf per plant. The average yield is.—

Y 10	8 13	± 0.92
E 1	56.5	± 1.28
Dwerghoorn \times Kanari	81.5	± 0.65

(2) There are material differences between the various types in resistance to wind. The action of strong air currents influences in various ways and degrees the plants, preventing development and reducing the yield to $\frac{1}{8}$ of the normal quantity and even to less. Under equal conditions the number of these plants varies, being naturally all the smaller the greater the resistance to wind. On a general average, for the types studied the following are the percentages of bad quality plants:—

Y10	14.8	± 1.46
E1	22.2	± 1.81
Dwerghoorn \times Kanari	7.5	± 1.19

The varying degree of wind resistance probably explains the difference in yield per unit of area in favour of the most resistant type, viz. Dwerghoorn \times Kanari.

(3) The cross Dwerghboom \times Kanari has shorter leaves than those of other two types Y10 and E1.

(4) In quantity of produce, the cross is superior to Y10, while E1 takes last place.

1127 - The Effect of Cross-Pollination on Size, Colour, Shape and Quality of the Apple.

— WICKS, W. H., in *Monthly Bulletin of the State Commission of Horticulture*, Vol. VII, No. 10, pp. 568-573. Sacramento, Cal., Oct., 1918.

Results of a series of investigations during the three years 1915, 1916 and 1917 in a typical commercial orchard at Springdale (Arkansas), in order to ascertain the influence and effect of the pollen of the male parent of the apple on size, colour, shape and quality of the fruit of the female.

The following crosses were made Ben Davis \times Ben Davis — Ben Davis \times Jonathan — Ben Davis \times Grimes — Ben Davis \times Winesap — Jonathan \times Jonathan — Jonathan \times Ben Davis — Jonathan \times Grimes — Jonathan \times Grimes — Winesap — Grimes \times Grimes — Grimes \times Ben Davis — Grimes \times Jonathan — Grimes \times Winesap — Winesap \times Winesap — Winesap \times Ben Davis — Winesap \times Grimes — Winesap \times Jonathan.

In addition to these varieties being of leading commercial importance, they possess intense colour, quality and characteristic shape. As the Grimes, develop a uniform rich yellow colour, it was thought that the pollen from a red variety like the Jonathan and Winesap would manifest itself when placed on this variety. The yellow of the Grimes would likewise be dominant when this variety was used as male parent, the same as regards the size, form and quality.

Hand-pollination was carried out by the recognised method. Weather conditions often are unfavourable to this operation which in every case should not be prolonged beyond the third day after the stamens are removed from the blossoms.

In 1915, 4380 pollinations were made and 568 fruits harvested, in 1916, 3813 pollinations were made giving only 76 fruits, in 1917, 3097 pollinations were made, producing 129 apples. The total of fruit set for Grimes as female parent, using the other three varieties as male was 49.26 %; similarly for Ben Davis 32.71 %, for Jonathan 18.67 % and for Winesap 9.42 %. The greatest affinity exists between varieties as follows: — Ben Davis \varnothing \times Grimes — Grimes \varnothing \times Jonathan — Grimes \varnothing \times Ben Davis — Ben Davis \varnothing \times Jonathan.

The results of work covering 3 years gave the following conclusions:

1) No evidence of influence of the male pollen of any variety can be detected in size, colour, shape or quality of the female parent.

(2) Variations in these characters are evidently due to cultural factors (manuring, time of picking) and weather influence (light, temperature and moisture).

1128 - The Creation of Direct Bearers and Mendelism. — LARUE, P., in *Revue de Viticulture*, Year XXVI, Vol. 50, No. 1297, pp. 289-294. Paris, May, 1919.

The results of a series of crosses between American and European vines, which were carried out at the Ville de Colmar Vine-Growing Insti-

tute with the object of obtaining direct bearers resistant to phylloxera and to cryptogamic diseases. Remarkable results were obtained with: Gamay \times Riparia 702 A, 702 B and 702 C (three white hybrid direct bearers) — Rupestris du Lot \times Madeleine Royale — Goldriesling \times Riparia gloire — Goldriesling \times Rupestris metallica — Millardet 101-102 \times Kniperlé, etc. The best known of these hybrids are: Riparia \times Gamay 595, 604 and 605. They have already been widely introduced in Burgundy, and in the Departments of Saône-et-Loire, and the Côte-d'Or. Pips of these three varieties have been sown several times, but without any positive results. The individuals of the F_3 generation resemble the wild species of Riparia, and have male flowers with some female ones, or else they are of the European type, and possess all the characters of the Gamay parent, being even more susceptible to cryptogamic attack than the mother plant. No true mixture of the characters of the two parents then occurs, and the facts observed can be explained in the same manner as the mendelian schemes.

Gamay \times Riparia 702 A grows vigorously, and the hard brilliant leaves, like the grapes, remain healthy without the application of copper mixtures. The vine is strong, and each branch bears 3 or 4 branches a little below the average in size, with good grapes without any foreign flavour, but very small. 702 B bears very large leaves, and fine bunches of large well-flavoured grapes. The European character is strongly dominant, hence the vine is susceptible to cryptogamic attack. 702 C is not attacked by fungoid parasites, and its yield is good, but its foliage leaves much to be desired. Experiments in crossing the three above-named species with one another, or with other white types, are still in progress, with the object of obtaining resistant hybrid direct bearers of good quality. The work, as can be seen, is however entirely empirical. It is, in fact, practically impossible to apply the mendelian laws. Further, even if the transmission of characters followed the rule of separating and re-combining, the enormous number of possible forms, and the very long time required for testing the successive generations, would constitute almost insuperable obstacles to the solution of problems that urgently need solving without delay. Mendel himself stated that it is impossible to predict the composition and nature of offspring where the number of independent characters is very great. With 7 different characters, 16 384 individuals can be obtained, and these may be grouped in 2 187 determinate forms, of which only 2 are represented by a single individual. In the case of the vine, it is a question not of 7, but of at least a dozen characters, so that the number of possible combinations would become practically infinite.

1129 - A Permanent Modification Resembling a Mutation Observed in the Sycamore (*Acer Pseudoplatanus*), in the Netherlands. — VAN DER WOLK, P. C., in *Cultura*, Year XXXI, No. 367, pp. 52-105, pl. 1. Wageningen, March, 1919.

The *albomaculata* variety of *Mirabilis Jalapa* is characterised by variegated foliage. Some of the leaves are of a yellowish white, more or

less streaked with green, others are completely green or white, and there is a series of intermediate variations.

By pollinating the flowers of a white branch with pollen from a normal plant, white seedlings are produced, which are incapable of development, and soon perish. On the other hand, the reciprocal cross gives green, normal plants. Thus, the *albomaculata* character is only transmitted from the maternal side.

According to CORRENS, this character is due to a disease which is localised in the protoplasm and transmitted by it. Since the protoplasm of the embryo is derived only from the female parent, it is easy to understand why this character should be transmitted from the maternal side alone.

The hypothesis suggested by CORRENS has been experimentally confirmed by the researches made by the writer upon the sycamore (*Acer Pseudo-Platanus*). There appeared suddenly on a normal tree some branches with leaves very different from those borne by the others: with blades (without chlorophyll), or else variegated white and green; more deeply incised lobes, narrow and with right-angled sinuses. A fine down gave these leaves a characteristic glossy appearance. The petiole was not red, as in normal leaves, but yellowish-white with dark brown streaks. Further, and this was the most important character, these abnormal branches bore exclusively male or exclusively female flowers, whereas the branches of normal trees have always a large number of hermaphrodite blossoms in addition to the unisexual ones.

What is the origin of this variation? The writer observed the following facts: the abnormal branches almost always grow in the immediate neighbourhood of some wound (due to pruning, or some other traumatism) where the ligneous mass is more or less profoundly altered, or even decayed. There is a correlation between these dead parts and the occurrence of abnormal branches. This has been proved by inoculation experiments. The dead wood was reduced to powder and mixed with water, and healthy branches were inoculated with the mixture; next year, the buds of the parts thus infected produced branches of the abnormal type described above. Similar results can be obtained the same year by inoculation near the growing point, or by infecting seedlings that have just germinated.

As for the abnormal branches (whether natural or resulting from inoculation), they reproduce in a vegetative manner, and preserve their characters constant, like a bud variation or mutation.

This modification is certainly connected with the decayed parts of the tree, and after making a series of experiments, the writer succeeded in isolating a bacillus which he calls the "modification bacillus", and which must be present if the above-mentioned phenomena are to take place.

Encouraged by this discovery, the writer studied the behaviour of hybrids resulting from crossing white with green individuals. He obtained the following results:

$$\begin{array}{l} \text{White } \text{♀} \times \text{Green } \text{♂} = 13 \text{ individuals, all white} \\ \text{Green } \text{♀} \times \text{White } \text{♂} = 9 \text{ " " " } \end{array}$$

These results are explained by the fact, that, in each case, one or other of the sexual cells is infected by the bacillus and the infection is transmitted to the whole embryo.

Control experiments further showed that:—

White ♀ × White ♂ always gives white offspring
 Green ♀ × Green ♂ " " green "

In another experiment, the writer inoculated healthy inflorescences shortly before pollinating them with pollen from other healthy inflorescences. The results were very different from these obtained before: they were identical with those that CORRENS obtained in making reciprocal crosses between *Mirabilis Jalapa* and *Mirabilis Jalapa* var. *albomaculata*, i. e.:—

The cross White ♀ × Green ♂ produced entirely white offspring
 " Green ♀ × White ♂ " " green "

As an explanation of this unexpected result, the writer suggests that during the short time elapsing between inoculating and crossing, the bacillus had been unable to penetrate from the protoplasm into the nucleus, and as the protoplasm of the embryo was entirely derived from the female tree, the respective character was transmitted only from the maternal side.

Once this modification is produced, it remains constant and is transmitted independently of the presence of the bacillus. We therefore have here to do with a permanent modification, which is very similar to a true mutation.

CEREAL
AND PULSE
CROPS

1130 - Spanish Varieties of Wheat. — FERNANDEZ DE LA ROSA, G, in *Boletín de Agricultura técnica y económica*, Year XI, No. 121, pp. 40-48, and No. 122, pp. 142-150. Madrid, Jan. and Feb., 1919.

At the beginning of the 19th century, SIMON DE ROJAS CLEMENTE Y RUBIO brought together in the province of Grenada a very rich collection of wheats. The edition of HERRERA'S work, published in 1818 by the "Real Sociedad Economica Matritense", was written with the collaboration of the most eminent botanists of the age who contributed to it commentaries and additions. The writer summarises these in so far as they relate to Spanish wheats.

There are 7 varieties of caryopses that are husked and with fragile rachis, of which only one is grown in any appreciable quantity, the "escaña melliza" or "escaña de dos carreras", i. e. double grain (*Triticum Cienfuegos*), known in Navarre as "escandia" and in Catalonia "espelta bascona". In the Balearic Islands, the "trigo Polonia" (*Triticum Polonicum*) is little grown. To the other species of which at maturity the bare seed falls out, i. e. wheats proper, belong the:— "candeales" (spring wheat, *Triticum aestivum*); "chamorros" (winter wheat, *Tr. hibernum*); "redondillos lampiños" (small, awnless, round); "redondillos vellosos" (small round awned, *Tr. turgidum*, which are all soft wheats) — "fanfarrón lampiño" (*Tr. fastuosum*, awnless glumes); "fanfarrón velloso" (*Tr. fa-*

sinuatum, awned glumes); "chapado" (flat seed, *Tr. cochleare*); "cuchareta" or "chapado velloso" (flat, awned); "morunos" (brown or black types of *Tr. durum*) hairless and awnless, which are all hard wheats. This classification is the one by CLEMENTE.

Among the best hard wheats must be mentioned the selected families of "macolo" and "alonso" of the Cadiz district.

Several attempts have been made to acclimatise foreign wheats. The writer has tried Bombay, New Zealand and other sorts supplied by the firm of Vilmorin, but he has always found rapid degeneration set in.

1131 - Cereal Growing in Cyrenaica. — See No. 1063 of this Review.

1132 - The Soya Bean: Its Culture and Uses — MORSE, W. J., in *Farmers' Bulletin* 973, U. S. Department of Agriculture, 32 pp., 15 fig., Washington, July, 1918.

Description of the climatic adaptability, methods of growing and use of the soya bean, with short descriptions of the most important commercial varieties and recently selected types.

In general, the climatic adaptability of the soya bean are about the same as those of maize. It is more drought resistant and less sensitive to an excess of moisture than cowpeas and maize, and succeeds best on fertile sandy loams and clay loams. When sown on land not previously planted to this crop, it is advisable to inoculate the soil with a proper culture (limited quantities of pure culture supplied free of charge by the U. S. Department of Agriculture), or by the use of inoculated soil from a field where soya plants have previously developed root nodules.

The best time for planting is about that for planting maize. About 20 varieties are now in use. During the past 10 years, more than 800 lots of seed for testing with a view to their introduction into the country have been received by the U. S. Department of Agriculture from China, Manchuria, Japan, and India.

The more important commercial varieties and recently improved sorts are— Barchet, Biloxi, Black Eyebrow, Chuquita, Early Brown, Elton, Guelph, Haberlandt, Hahto, Hollybrook, Ito San, Lexington, Mammoth, Manchu, Medium Yellow, Mikado, Peking, Shanghai, Tokyo, Virginia, Wilson Five, and Yakotenn.

The soya bean may be combined in many systems of crop rotations, as the cash value of the seed is sufficient to encourage growing the beans as one of the main crops. Grown as a forage crop associated with maize, cowpeas and sorghum, soya supplies a better balanced ration, a larger yield of forage and greater variety. Grown for seed, it has the following advantages: — large yield, uniform maturing habit, increasing demand for seed for planting, for human food or for oil-extraction. The feeding value of the seed compares favourably with other concentrated feeds. The straw obtained from threshing is a valuable feed for stock. Soya bean hay is excellent; the yield varies from 1 to 4 tons per acre. Soya may be used as pasture for all kinds of stock, especially for hogs to supplement the maize ration. Mixed with maize, it gives excellent silage

ENEMIES AND DISEASES. — No insect or fungous pest has assumed any great economic importance as an enemy to the soya crop. Root-knot, caused by a nematode, often considerably injures the beans in many sections of the Southern States where this pest is prevalent. In such sections the beans should not be planted.

STARCH-CROPS

1133 — **Method of Growing Potatoes in Winter.** — HUGUES, C., in *Il Villaggio*, Year 44, No 33, p. 2. Milan, August 16, 1919.

During the winter of 1903 the author found out that new potatoes came on the market of Gorizia at the period of most intense cold. He found they came from Germany, where late planting in the very cold spring of 1902 did not allow the potatoes to mature before winter, so that a large part of the crop was left in the field during the winter.

What happened there through force of circumstances was followed soon afterwards by the experiments carried out by M. SCHREIBAU in France. These showed that certain varieties of potato, such as *Magnum Bonum*, if planted at the end of July and overtaken by frost when in full growth, may be left in the ground all winter. They must be protected from frost by a mulch of earth and manure, and may be lifted as they are required for sale as new potatoes in winter or spring.

Other trials made later in Brittany showed that to prevent these potatoe freezing in the ground an ordinary moulding up along the drills is sufficient. At Paris, with a winter temperature as low as -10°C , a layer of earth 20 cm. deep is all that is necessary, in other places with a temperature as low as -14°C . a layer 25 cm. deep was sufficient.

The writer gives the following directions for growing potatoes a second time (summer planting): The varieties which will keep until planting time must be kept till about the end of summer. Tubers to be planted should be left in the light so as to grow short healthy sprouts later on, for rapid germination and growth.

If the tubers for planting are kept in cold storage at a constant temperature of 2° to 4°C . they will remain with their buds closed till autumn but are rather less productive than those kept in the light. The sprouting of refrigerated tubers is about a week later than ones exposed to the open air and light. Some early varieties, known as *Quarantain*, are not prolific enough, while late kinds are not mature by mid-November. After repeated trials between 1898 and 1902, mostly in the provinces of Bologna and Bergamo, it was found that, if planted on wheat stubble in the first half of July, the tubers of the previous year's summer crop gave a good yield in November. For this purpose a manure was applied to the stubble which contained $2\frac{1}{2}$ cwt. farmyard manure, 3 cwt. 15% superphosphate, $2\frac{1}{2}$ cwt. sulphate of potash and $2\frac{1}{2}$ cwt. nitrate of soda per acre as a top dressing.

Among the varieties suited for planting in July, the *Matilda* takes first place. To prevent the summer heat from drying the tubers before they sprout, they should be put rather deeper into the ground than usual, in rows about 20 in. apart, with the tubers about 14 in. from each other. Be-

fore being used for planting the potatoes should get a resting or wintering period lasting, according to the variety, from 40—60 days. Round Paris, lifting is done at two periods : in this system the earliest potatoes can be lifted in March and will do for planting the following July. The method of growing is the same as for potatoes planted in spring, only spraying with Bordeaux mixture should be done sooner and oftener, as the crop is much more liable to attacks of blight.

1134 - **The Bulrush (*Typha latifolia*) as a Source of Starch.** — KOFER, IUDWIG, in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol XXXV, Part 7-8, pp. 266-272, 3 figs Münster, 1918

Of the 5 species of *Typha* native to central Europe — *latifolia*, *angustifolia*, *minima*, *Shuttleworthii* and *gracilis* — only the first is of practical value (1). Otherwise, the entire plant or some of its parts has already been used in the arts or for medicinal purposes. Its rhizome is of special interest as a foodstuff in Asia, New Zealand and North America, being full of starch, especially in autumn or winter. LOZES found 46 % of starch in the dry matter, while THOMAS obtained only 30 % from rhizomes gathered in spring when some young shoots were appearing.

The writer describes in detail the rhizomes, roots and stolons, as well as the flour obtained from them.

Two distinct types of starch grain have been observed : (a) *large*, from simple to triple ; a grain measures 13 μ in diameter ; the hylum, if visible, is central ; the lamellae are not visible — (b) *small*, simple or compound, ordinarily simple, with an average diameter of 3.5 μ . The tubes have scalariform thickenings ; the vascular bundles of the sclerenchyma are formed of thin-walled fibres, with oblong dots and arranged at 45° to the longitudinal axis. The star like parenchyma composing part of the cortex contains only small starch grains. The inclusions (Inklusen) have a special diagnostic value. They are distributed in the tissue uniformly but not in quantity, and contain, immersed in a gummy mass, phloroglucinol and derivatives of catechin of a nature similar to that of tannin. In sections or powdered, treatment with paradimethyl-amido-benzaldehyde and sulphuric acid colours these cells wine red, while the other tissues remain colourless.

The writer then gives the main characteristics of *Pteridium aquilinum*, *Cyperus*, *Asphodelus*, *Scurpus*, *Juncus* and other aquatic plants.

FERNS (*Pteridium aquilinum*). — As researches by other writers using the ordinary methods of analysis had not shown any poisonous

(1) *Typha latifolia* serves most varied purposes. Its rhizomes when cut up, well washed, cooked and roasted are a food, they contain much starch and sugar ; in north Russia they serve for bread making when made into flour. Young plants or young rhizomes are cooked in sugar or later as salads. The rhizomes on fermentation yield a sort of alcohol. Horses eat the young leaves greedily. During the war attention was centred on the cottony envelope surrounding the fruits, in view of the possibility of using it as cotton substitute (textile fibres, cellulose for explosives) — O. MATTIROLI, Phytochimurgia Pedemontana, in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LXI, pp 126-127. Turin, 1918. (Ed)

substance in the plant, large quantities of this fern were collected for use as food or fodder. Bread was made which contained a considerable amount of it and which, especially in Bosnia, caused dangerous illness and in some cases death. The roots and rhizomes of *P. aquilinum* contain starch grains of oblong irregular shape, tracheae with pores thickened at the borders and a brown, very suberous bark (1).

FORAGE CROPS,
MEADOWS
AND PASTURES

1135 - The Improvement of Fodder Plants in Morocco; Interest of *Lotus arenarius*. — FRON and RIGOTARD, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol V, No 26, pp 698 699 and 704-709 Paris, July 16, 1919

Mr SCHRIBAUX has sent the Academy a note of Messrs. FRON and RIGOTARD stating that they are about to publish a series of monographs on the more notable species, selected from those specially preferred by live stock in the north of Africa.

In the same note they begin to direct attention to the *Lotus arenarius*, a plant of many forms spread over a very limited area. It is localised in the south of Portugal and of Spain, and has been found in the Canary Islands and in Morocco from Tangiers to Agadir.

There are two extreme types, one very small, *L. arenarius* var *minor* of no agricultural value, and the other *L. arenarius* var *major*, which may reach 1 ft 7½ in in height. There is no doubt but that a meadow growing this sort of plant, whether combined or not with other fodder species, would give high yields. The plant appears to need lime, and succeeds best on deep light land, even though poor in fertilising ingredients except potash.

1136 - Note on the Grasses Growing in Coconut Plantations in India. — TADULINGAM, C, in *Year Book 1918 of the Madras Agricultural Department* pp 87-92 Madras, 1918

The writer studied the herbaceous flora of the young coconut plantations in the neighbourhood of Pilicode (Charvatvor) and Nileshwar, in the South Kanara district, and indicated as Nos I, II and III Plantation No I is at Pilicode with a laterite soil and Nos II and III near Nileshwar with a rich red loam and sandy soil respectively. The ground at the three plantations was covered with a good growth of grasses and each one was protected against cattle trespass. A good fodder was obtained, was stacked for use as hay.

The writer found among the grasses of the coconut plantations surveyed three species of special interest, one of them, *Eragrostis tremula*, an elegant looking annual, is a typical member of the sand flora in this region and was for the first time collected for the Madras Herbarium from the Southern province. The others are two *Dimeria* of the west, locally known as "Nai pullu" and "Severu".

(1) GRESHOFF found in *Pteris aquilina* (= *Pteridium aquilinum*) a cyanogenetic glucoside similar to amygdalin. Only the mature plants produce hydrocyanic acid. — *Botanical Abstracts*, Vol. I, No 5, p 220 London, Jan, 1919.

In the list of the grasses which he gives, the author distinguishes three types of prevalence which he represents by the initials: D., or dominant, which are powerful enough to form the greater portion of the vegetation spreading over large tracts in the areas examined — S. D., or subdominant species, which, though sufficiently powerful, occur in patches here and there — Sp., or sporadic, which occur in single plants or in groups of very few. The following is the list for plantations I, II and III: —

No I. — *Ischaemum ciliare*, Retz (D.), *Andropogon contortus*, Linn. (D.); *Dimeria* spp. (2 species) S. D.); *Apocopsis vaginatus*, Hack (D.); *Arundinella Metzii*, Hochst. (Sp.); *Pseudanthistiria heteroclita*, Hk. F. (S. D.); *Pollinia argentea*, Trin. (Sp.)

No. II.; *Andropogon contortus*, Linn. (D.); *Apocopsis vaginatus*, Hack. (D.); *Ischaemum ciliare*, Retz (S. D.); *Dimeria* (2 species) (S. D.); *Perotis latifolia*, Ait (S. D.); *Pollinia argentea*, Trin. (Sp.); *Themeda imberbis*, T. Cooke (= *Anthistiria imberbis*, Retz) (Sp.) *Th. tremula*, Hack. (Sp.); *Arundinella Metzii*, Hochst. (Sp.); *Eragrostis stenophylla*, Hochst (S. D.); and some other species of very little importance.

No. III. — *Eragrostis tremula*, Hochst. (D); *Eragrostis amabilis* (S. D.); *Andropogon contortus* (S. D.); *Perotis latifolia* (S. D.); *Arundinella Metzii* (Sp.); *Ischaemum ciliare* (Sp.); and some other species of insignificant importance

1137 - Experiments in Cotton Growing in 1918 at the Palermo Colonial Gardens. — LANZA, D., in *Bollettino di Studi ed Informazioni del R. Giardino Coloniale di Palermo*, Vol. V, Nos. 1-2 pp. 51-62. Palermo, 1919.

FIBRE CROPS

Cultural experiments were carried out with the following varieties: — Sicilian Biancavilla cotton; seed from a field at Trapani.

Upland; seed produced a year before in these Gardens from original seed from Vilmorin.

Boyd's' prolific; seed produced several years before in the Gardens.

Mitafi, Abassy, Sakellaridis, Nubary; seed sent by the Société Sultanienne d'Agriculture, of Ghiza, Egypt.

The method of growing was the same for all the varieties tried. The ground, which was in good condition, was prepared with an ordinary ploughing a fortnight before sowing. After this cultivation, it was manured with a mixture of 50 parts superphosphate, 30 of cyanamide of lime and 20 of sulphate of potash. Seeding was done from March, 1 to 22 on days following the rains which ordinarily fall at this period, and, in the absence of rain, after previously irrigating the ground. The seed was sown in holes spaced at distances of 12 × 16 inches, 3 to 5 seeds at each hole.

The seeds all took almost exactly the same time to germinate, i. e. about 15 days. When the seedlings were about 4 in. high, or at the full development of the first leaf, which happened about 1 month after germination, the first tillage was carried out. A fortnight later a second tillage was done, and at the same time thinning out, leaving 1 or 2 seedlings, moulded up, in each hole.

One of the first experiments consisted in growing the above-mentioned 7 varieties without irrigation. The amount of rainfall during the growing period was, in millimetres: — March 30.8; April 34.8; May 120; June 90; July 2; August 1; September 57.4; October 99.6.

The different varieties behaved in almost the same way as regards growth, but there were striking differences in the times at which the bolls were ripe and in the yield of cotton. In regard to the period at which the bolls were ripe, the group of Egyptian cottons (Nubary, Mitafifi, Abassy and Sakellaridis), varieties of the species *Gossypium barbadense* were quite distinct from the group of Americans (Boyd's Upland, Biancavilla), of the species *G. hirsutum*. The Biancavilla is put among the American cottons because in morphological and floral characters it is extremely close to Upland, of which the writer considers it a modification by adaptation to Sicilian conditions. Table I, which summarises the data relating to the growth and yield of the 7 cottons used in the experiment, seems to show that Upland, in comparison with Biancavilla, requires more days between sowing and ripening, but this is not really so, because sowing Upland in advance causes a delay in the first phase of its growth, the difference in growth between the two varieties afterwards disappearing and flowering being reached by both varieties in the same time. The same is the case for Boyd's. This observation shows that excessively early sowing of cotton is not a means to hasten flowering and ripening, but has the disadvantage of exposing the seedlings to the dangers of rough weather. The Egyptian cottons ripen much later, except Mitafifi, which is not much later than the American varieties. Late ripening is a defect, both because the lint is generally inferior in quality and because the rains which always fall in autumn greatly deteriorate it.

Table I shows the great superiority of Biancavilla over all other varieties used in the experiment, both in total yield and in yield of ginned cotton. Next and almost equal come Upland and Mitafifi. Consequently, the cottons that ripen earliest are also the most productive, except Boyd's, which takes almost last place for yielding-power and which nevertheless flowers and ripens its bolls in the same time as the two varieties just mentioned.

The industrial characteristics of the lints dealt with in Table I were investigated by the "R. Stazione Sperimentale per l'industria della carta e lo studio delle fibre tessili" of Milan (Royal experiment station for the paper industry and the study of textile fibres).

The results of the technological examination put the Biancavilla and Boyd's varieties in the last place and Mitafifi in an intermediate place. Hence the trials show that the Sicilian variety, early ripening and more productive than all the others, is least good as regards quality of the product, and that among the other varieties tried, Upland and Mitafifi are the two which, as non-irrigated crops in Sicily and almost as early as Biancavilla, combine the advantages of quantity and quality in the product. The Biancavilla variety shows excellent drought-resisting qualities, great earliness and plentiful yield. It should be selected with a view to

improving the quality of the lint. Upland and Mitafifi may be grown perfectly well in Sicily without irrigation.

TABLE I. — *Growth and yield of non-irrigated cotton crops.*

	Biancavilla	Upland	Boyd's	Mitafifi	Sakella ridis	Nubary	Abassy
<i>Phases of growth</i>							
Seed time	March 2	March 1	March 6	March 2	March 22	March 22	March 22
Germination	April 1	March 15	March 6	April 6	April 6	April 1	April 6
1st flower open	July 5	July 5	July 10	June 30	July 9	July 8	July 6
1st capsule dehiscent	Aug 19	August 20	Aug 20	Aug 29	Sept 2	Aug 29	Aug 28
End of harvest	Sept 30	Sept 30	Sept 30	Oct 10	Oct 28	Oct 26	Oct 20
<i>Yield per sq metre</i>							
Untinned cotton kg	0 1069	0 0700	0 0325	0 0740	0 0450	0 0461	0 0107
Lint	0 0388	0 0243	0 0140	0 0267	0 0150	0 0141	0 0116
Seed	0 0680	0 0477	0 0187	0 0246	0 0300	0 0320	0 0290
Proportion of lint to seed	0 5 0	0 467	0 745	0 600	0 500	0 440	0 400
<i>Test of lint</i>							
Resistance in grammes							
maximum	9	6 6	7 4	7	9 3	7 9	7 8
minimum	1	1	0	3 5	2 7	2 4	3 2
average of all determinations	4	4 7	5 1	4	5 7	4 8	5 8
Average % extensibility	4	2 0	2 0	3 4	2 2	2 0	2 0
Length, in mm	24-26	32-34	21-23	28-30	2 34	27 2	30-32
Diameter							
maximum	6	-	3 5	5 0	2 5	3	2 5
minimum	12	1	1	10	10	10	10
average of all determinations	11	16	21	10	17 7	20	17 5
Colour	white bluish	white bluish	white bluish	white more reddish than Sakella aridis	white tending to reddish	almost like Mitafifi	white bluish

The writer crossed Biancavilla with various foreign cottons and obtained many fertile seeds which were to be sown in 1919

Another experiment aimed at determining the differences in the growth of the plants and the quality of cotton obtained from non-irrigated and irrigated crops of the same variety.

For this purpose Boyd's Prolific was chosen, and was sown on three equal plots: the first with no irrigation, the second irrigated twice, on June 15 and July 19, and the third irrigated 4 times, on June 15, July 3, July 28 and August 10. The results obtained, as sown in Table II, show that the growing period of Boyd's was in no way affected by drought or irrigation, but that the plants in the 3 plots flowered and ripened in the

same time. This leads the writer to believe that the progress and duration of growth and fruit-setting constitute a varietal characteristic, depending on temperature but not on water supply. In order to test this idea, the writer repeated the experiment with various other varieties.

On the other hand, the effect of irrigation on the growth and yield of the plants was very great, and was exactly proportionate to the amount of water supplied

TABLE II. — *Growth and yield of Boyd's Prolific cotton grown without and with irrigation.*

	Not irrigated	Twice irrigated	4 times irrigated
Seedtime	March 6	March 6	March 6
1st flower open	July 10	July 9	July 10
1st capsule burst	August 20	August 20	August 23
End of harvest	Sept 30	Sept 30	Sept 30
Area sown, sq metres	160	160	160
Total yield, in kg	5 250	10 750	20 000
Ginned cotton "	2 250	4 250	7.500
Seed "	3 000	6 500	12 500
Height of plants at August 4, in cm	35	45	65
" " " 30, "	35	55	80

1138 — **Cotton in North Africa** (1). — CAULIA, V. I. Inquiry on cotton growing in Egypt, Algeria, Tunis and Morocco in 1917. in *Annales de la Science agronomique*, Year XXXVI, Nos 1-6, pp 1-46 and 145-203, 1 chart, bibliography of 53 works. Paris, Jan-June 1919
— II Cotton growing in French North Africa, in *L'Agronomie coloniale, Bulletin mensuel du Jardin Colonial*, New Series, Year III, No 23, pp 145-151, 1 map. Paris, March-April, 1919

I — Under authority from the Ministers of Commerce and Foreign Affairs in France, the author studied cotton growing successively in Egypt, Algeria, Tunis and Morocco in his inquiry carried out when on a mission to these 4 countries in 1917. His own observations are supplemented by information gathered in the course of two journeys to Morocco and another to Algeria and Tunis during which he was with Mr. H. COSNIER, Deputy, Agricultural Engineer, and General Commissioner for Agricultural Production in North Africa and in the Colonies

The objects of the mission were : — (1) To seek in Egypt — the region in Africa where cotton growing is most advanced and which shows most similarity to French North Africa — points of comparison and hints for cotton growing in Algeria, Tunis, and Morocco.

(2) To determine the possibility of establishing or extending cotton growing in these three possessions, with the object of augmenting the supply of cotton for the industry in France.

(1) See R., March, 1917, No 243 (Ed.)

The author begins with Egypt and studies in succession, after considerations of a general character, the decrease in the average yield and its causes (soil moisture, fertility, insects), the falling off in quality (1), the seed, trade, and future of cotton in Egypt.

On regarding French North Africa as a whole, it will be seen that from the point of view of cotton production extreme opinions should be put aside. One must not, like the pessimists, look at the natural difference in position which distinguishes it from Egypt and conclude that cotton growing is an impossibility. Neither is it desirable to believe those optimists who think they can find in the three French possessions the million bales of cotton consumed annually before the war by the industry of France. French North Africa, though occupying a position with conditions no more than favourable, can supply France with cotton for her mills. It is, besides, benefited by the proximity of the home country, which should ensure to it the lowest freight rates, for shipment there, of all cotton-growing countries.

Irrigation, according to the author is necessary in French North Africa in order to make cotton growing pay, and it compels the cultivation of Egyptian varieties. This necessity, along with the other to obtain a product of such quality as to leave a wider margin of profit, leads to the conclusion that the fibre should be of the Jumel type. Many years hence, as it depends on the management of the irrigation system, the 80 000 bales (about 25 000 tons) which France imported from Alexandria before the war could be produced in French North Africa — i. e. an amount over 150 times greater than was produced there in 1917 or 1918. By the efforts of Algeria alone, its present production could be quintupled from one year to the next.

Of the three French possessions, Tunis on account of its less extensive cotton area and its smaller resources in water-power seems to have less of a future, while the lack of a system of controlling its water power scarcely allows early development be reckoned on for its cotton production, which since 1914 has been nil. The Sahara oases cannot be depended on, but only north Tunis up to Bizerta and the higher plateau near Kairouan irrigated by the waters of the Wadi Zeroud.

In Algeria, cotton can be grown in the Tel districts and also on the plain of Bône, in the Philippeville district, the parts of the Mitidja which bear neither vines nor citrus fruits (which give higher returns than does cotton), the lower Chelif valley and the low Oran plain. This country, after many vicissitudes, a phase of prosperity, then a total decline, has seen the farmers of Bône and Philippeville prefer other crops (e. g. tobacco), which they consider more profitable, to cotton. It has seen also two cotton centres spring up, at Orleansville (Algiers) in the Chelif valley and in Oran (Perregaux, Habra, Saint-Denis du Sig, etc.). The annual production at present is about 130 tons of cotton lint, the greater part

(1) See under heading "The Deterioration of Egyptian cotton", *R.*, Dec., 1918, No 1356' (Ed.)

coming from Orleansville. This is no trial crop but a regular, well established agricultural production. The method by which the problem has been solved there would merit longer study. The smallest details about the crops have been worked out (not only for cotton but for the whole rotation, which it has been sought to make as nearly as possible like the Lower-Egyptian one); the ginning and selling problems have been solved by forming a co-operative society which works well. With the recent trend of prices for cotton, in spite of the considerably increased cost of water since the war began, the net profits in 1917 in this region reached 3 000 francs per hectare, the cotton selling at 6.90 and 7 francs per kilogramme. It may be estimated that in normal times, with the average price for this fibre, an irrigated cotton crop should leave an average profit per hectare of at least 500 francs, with an outlay which would amount to 500-600 francs.

Oran has not generally got so good a result as Orleansville. Cotton growing there is much less developed, although the conditions for cotton production obtaining there are as good or even better than at the latter place. This state of affairs is mostly due to the fact that as the ginning and sale of the cotton are not organised industrially and commercially, the producer finds no marketing facilities.

The problem shows in another light in western Morocco. This is the region in French North Africa best provided with water and cotton lands, but its agricultural evolution is backward and its organisation, economics and colonisation are much less developed than in Algeria. Its wealth of water power has still to be harnessed. All these conditions remove cotton growing on any great scale to a period well in the future. With the rapid advance in its development its economic conditions are being transformed quickly and completely, so that it can scarcely be foreseen what they will be in a few years, and consequently what the interest will be for the producer to grow cotton in districts suitable to raise other crops. In the Sherif Empire cotton can be grown on the Triffa plain, a large part of the wide valleys of the Wadi Sebou and certain of its tributaries, various districts on the Wadi Um er Rbia, in the Hanz of Marrakech, in the Sharna country, in the centres near the coast (Salé, Azemmur) and a large part of the Sus.

In order to increase the cotton growing area, the following requirements exist at present: - in Tunis, especially the harnessing of the water; in Algeria, facilities to the producer for preparing and selling his crop so that this crop is no more difficult to manage than other crops which could be grown on the same ground; in Morocco, more complete economic institutions, better methods of cultivation and a system of irrigation.

In the whole of North Africa an energetic driving force is needed, sustained effort and that will to succeed which at Orleansville has overcome all obstacles. It should be remembered that in the regions best suited to the production of Jumel cotton, such as Egypt and the south west of the United States, several years of persistent work were necessary before success was attained.

Should the French consumption of Jumel cotton go up, it is probable

that the North African crop, even if extended to the maximum, will always remain insufficient to meet it. In spite of the great French requirements in short staple cotton the growing of these varieties will have to be left to other French colonies, and Egyptian varieties will have to be specialised in; it may even be that cotton growing in North Africa can be only transitory, having to give place to richer and more costly crops. This colony nevertheless will have helped to supply raw material for French industry, until other French colonies, which will become more suited economically to growing, this crop, may be able to take its place.

1139 - An Improved Type of Cotton for the South of British India. — KOTTUR, G. I. (Cotton Supervisor, Southern Division, Bombay Presidency), in *The Agricultural Journal of India*, Vol. XIV, Part. I, pp 165-167. 1 pl. Calcutta-London, Jan., 1919.

Cotton is the most important crop in the black soil tract of the Southern Maratha Country (Dekkan) and covers a very large area in the districts of Dharwar, Belgaum, and Bijapur of the Bombay Presidency. The adjoining cotton-growing areas in the Madras Presidency and in the Native States of Kolhapur, Miraj, Sangli, Hyderabad, and Mysore present similar physical features and grow the same variety of cotton. The problems for solution in connection with cotton are, therefore, the same for the whole of this tract.

Except for a small area under Dharwar-American cotton, the whole of this tract grows a variety of *Gossypium herbaceum*, known in the local vernacular as *jowari-hatti*. It is botanically identical with Broach cotton, but agriculturally it differs in many points. It is a late sown cotton producing seedy *kapas* only $\frac{1}{4}$ of which is lint. The latter reaches the spinners under the name of Kumpta cotton, which ranks high in the list of long-staple *desi* cottons. In India there are few long-staple cottons and these are in danger of being ousted by short-staple varieties. In the Southern Maratha Country, however, conditions are unfavourable to the growth of short-stapled varieties, and the tract is recognised as essentially a long-staple tract. Attempts to introduce other long staple cottons were made and cross-fertilisation also was tried, but without success. Selection from the local variety *jowari hatti* was therefore the only sure method left.

What are the characteristics of the local *jowari hatti* cotton? It is sown in August-September and is ready for the first picking by February-March. It is a stunted plant with a small average outturn of *kapas* per acre and a low ginning percentage (25 %). The average outturn of *kapas* is taken at 320 lb. per acre giving 80 lb. of lint. The staple, though long, is uneven and often weak. These defects gave an indication as to the directions in which improvement was indicated.

A study of the local cotton shows there are two distinct types to be found, the erect type and the bushy type. The erect type is characterised by the meagre development of limbs and vegetative branches and the strong development of fruiting branches. Continued field tests have shown the superiority in yield of this erect type, and by selection a plant has been got which yields 12 % more *kapas* than the local unselected cotton; a *kapas* which yields 12 % more lint than the local *kapas*, and lint which is valued at 5 % more than the best Kumpta cotton.

It is proposed to multiply and distribute seed of this improved type, and it is believed by this means the economic condition of the cotton growers will be materially improved and the spinning value of the Kumpta cotton will be enhanced.

1140 - Study on the African "Da" Hemp (*Hibiscus cannabinus*); its Value for Paper Making. — HEM, F., MATROD, L., and MOREAU, F., in *Bulletin de l'Office Colonial*, Year XII, No. 136, pp. 247-258, bibliography of 14 works, and No. 137, pp. 321-341, 2 pl., Paris-Melun, Apr. and May 1919.

The writers studied Da of the Soudan district (= hemp leaved ketmie = Guinea hemp = *Hibiscus cannabinus*) of the Malvaceae family, which grows wild apparently in various parts of West Africa, and of which there exist several forms cultivated in the Niger and Bani valleys which are doubtless identical varieties with those defined by the botanists of British India. They show its geographical distribution and vernacular names in the various regions where it grows, the varieties in the Niger valley and in India, and cropping conditions in the Niger valley (cultivation, harvesting, retting and yields).

In West Africa as in British India, Da is a fibrous cultivated plant which, which, after cotton, is most used locally for purposes which the writers describe in detail. In spite of the large local consumption, in 1914 Upper Senegal-Nigeria exported 5 ½ tons of fibre. Investigations have shown that about the same period buyers could be found for important quantities of Da at 50 to 100 francs per kilogram *c i f*, according to quality, a slight extra payment being given for Da grown on dry ground. The export of Da provides a material profit, seeing that the prices in force in the Niger and Bani production centres before the war were from 15 to 20 francs in years of normal crops.

One hundred kg. of dry Da stems yield 18 to 20 kg. of fibre. In addition the central cylinder of the stem, which is left over after retting, yields 36 to 38 kg. of paper cellulose. The seed, of which 700 to 1000 kg. are obtained for every ton of dry fibre, has been shown on close investigation to contain 17 to 20 % of an oil suitable for food and soap manufacture. The residue of oilcake is also of interest as a cattle food and as a manure, on account of its nitrogen content.

The writers studied Da at the "Laboratoire général des Productions coloniales" in regard to its value for paper making, and the following are their conclusions —

(1) Chemical analysis of Da fibre shows a content of 70 % of fairly pure cellulose and 28 % of a lignin along with mineral matter and wax in small quantities.

(2) Technical trials showed a diminution in the theoretical yield to 55 % of so-called paper cellulose, or a loss of about 15 %. These tests gave a rough paper, very white, of good appearance, of medium firmness, fairly porous and with satisfactory resistance to pulling, tearing and rubbing. This yield is practically the same as is got generally with fibres, which varies from 50 to 70 % according to the purity of the product in question.

(3) This favourable impression is confirmed by the micrographic study of the pulp: the fibres, which the different treatments have neither swelled up nor deformed, appear to have the suppleness and solidity necessary for the preparation of a good paper pulp, while their felting power (0.008), very satisfactory, classes them with bamboo, jute and even alfa grass.

(4) Chemical determinations made on the pulp showed that the fibre, purified by previous retting, more or less coarse, it is true, nevertheless requires a fairly strong treatment on account of the resistance of its lignin constituent to the chemical reagents.

The impression left by all the laboratory tests is therefore quite in favour of the use of Da fibre for paper-making, and it is to be hoped that industrial application, using a large bulk of the material, will finally bear out the initial research. From an economic point of view, however, it would not pay to extract cellulose from Da fibre, since far more remunerative openings are available in rope making and spinning.

Hence it appears that the only use will be:-

(a) Either of the whole plant grown for its oilseeds, which yield 20% of an oil suitable for food or soap making.

(b) Or of the waste combings of the fibre used along with jute in the manufacture of fibre, cording, sacking, etc.

(c) Or of the residues and waste of manufactured material — old sacks, old cording, etc. — when this textile will be used in quantity in French industry.

Under these conditions, provided a sufficient and regular supply were forthcoming Da would be an interesting source of raw material for the paper-making industry.

1141 - **Growing of Sisal Hemp in Sicily.** - WHITAKER, G. I. S., in *Bollattino di Studi ed Informazioni del R Giardino coloniale di Palermo*, Vol. IV, Nos. 3-4, pp. 135-154, 2 figs. Palermo, 1919.

Several writers have declared that sisal hemp (*Agave sisalina*) can be grown in Sicily, but it cannot be said that there has been a complete series of practical trials, from planting to preparation of the products at the factory and their delivery on the quay for export, which could give this opinion the indisputable backing of fact. However this may be, what has been done up to the present and the knowledge of Sicilian conditions permit the estimate that the sisal hemp industry is above all possible and profitable on the uncultivated and arid lands. The writer was the first, after several years, to try the crop on a large scale, with young plants supplied to him by the "R. Giardino coloniale" of Palermo, in the island of San Pantaleo near Marsala, and then in the Marsala district. The date at which *A. sisalina* was introduced into the Palermo Colonial Gardens is unknown. Later on, the writer obtained other plants from different localities near Palermo and finally a thousand living plants from the colony of Erythrea, so that at present he has about 50,000 plants already big, besides those in his nurseries.

The writer advises planting in squares at two yard distances and on well worked land. The first year hoeing is necessary, and irrigating a few

times is very beneficial. The second year moderate irrigating is also useful (too much would rot the roots), and then hoeing will be all that is required. In the island of San Pantaleo the plants came up slowly the first 2 years but, once above the ground, they grew rapidly, so that in the 4th year the leaves were an average length of 4 ft. 3 in. and in the 5th year about 4 ft. 11 in., which would appear to be the maximum length in Sicily. Flowering began the 7th year, which shows the life of *A. sisalana* is from 7 to 9 years, while on more arid land it would probably be 9 to 12 or 13 years. The annual yield is 25 to 30 leaves per plant. With a yield of 25 leaves per plant per annum, at pre-war cost of labour and at a selling price of 30 pounds sterling per ton (at par), the writer estimates the profit from this crop at 250 *lirc* (£10 at par) per hectare (2 ½ acres approx). The quality of Sicilian fibre appears to be excellent.

Trials at growing *A. sisalana* have been made in several parts of the island, apparently with satisfactory results in the coastal belt but poor in the interior, at a certain altitude (it seems undesirable to go above about 100 metres in altitude, though the plant grows at higher levels, even in Ligurian gardens). Hail on the island does not damage the leaves, and the occasional slight frosts cause only little or no loss. On the other hand, the young tender leaves have a terrible enemy in the common snail, which is captured by hand.

Before the war, the machinery for extracting the fibre of sisal hemp came from abroad but now a patented fibre-extractor is made in Palermo at the works of the engineer Fileccia. Since some time back in Smythra, the machine invented and made by M. Santi Raffaele of Amara has been in use, and seems to work well, while it does not cost much.

1142 - **Bowstring Hemp (*Sansevieria*) and its Industrial Applications.** - MARTEL, G. E., in *Bollentino di Studi e Informazioni del R. Giardino Coloniale di Palermo*, Vol. IV, Nos. 31, pp. 163-182, bibliography of 8 works. Palermo, 1910.

Up to the present over 70 species of *Sansevieria* have been described (the writer gives the list of them and names their habitat) almost all utilisable for their fibre. Several are already grown on a large scale, others, grown experimentally, have given results that lead to the hope they may be multiplied and widely distributed. In 1903 (GÉRÔME, I. and LABROY, O., Sur la collection de *Sansevieria* des Serres du Muséum, *Bulletin du Muséum d'Histoire Naturelle*, Vol. IX, p. 167. Paris, 1903) 21 species of *Sansevieria* were growing at the Museum of Natural History in Paris, in 1915 (BROWN, N. E., *Sansevieria*, A Monograph of all the Known Species, *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, p. 185, 1915) at the Botanic Gardens at Kew, England, there were 43 species growing.

It was first thought to utilise in industry the natural reserves found especially in Africa, but this idea had to be given up for many localities, either because the reserves were far from easily accessible places, or on account of the small number of plants growing closely, etc. However, better results have been got by growing the plants, as they easily adapt themselves

(as do all the species) to different climates, are not exacting, resist drought, etc., multiply easily (by sowing, planting slips, fragments of rhizomes and even pieces of leaves), develop rapidly (much more rapidly than *Agave*), etc.

In the Italian colonies there are also several species of *Sansevieria*. In Erythrea there grow plentifully:— *S. abyssinica* N. E. Brown (= *S. guineensis* Schweinf., not Wild); *S. Ehrenbergii* Schweinf.; *S. Erythraeae* Mat. (= *S. cylindrica* Schweinf., not Bojer). In Italian Somaliland (Benadir) there are many varieties:— *S. abyssinica* N. E. Brown; *S. conspicua* N. E. Brown; *S. Ehrenbergii* Schweinf.; *S. Powellii* N. E. Brown; *S. rorida* Lanz; and some other species not yet identified.

The Erythrean species were experimented with by BALDRATI, who remarked the good quality of the fibre and the ease with which it could be extracted. The cost of cutting and transporting the wild plants to the factory is so high that it is better to cultivate them. It is proposed as suitable for the Arghazana valley, where there is a railway and where *Sansevieria* is already abundant.

In view of their geographical distribution, it seems that several species of *Sansevieria* could be grown with success in Sicily for industrial purposes. The Botanic Gardens of Palermo grows the following species, which are quite resistant in the open without shade:— *S. Dawei* Stapf.; *S. Perrotii* Warb.; *S. rorida* Lanz; and several other species as yet not identified. The author advises experimenting for Sicily, south Italy and Libya with the species which penetrate most towards South Africa (*angustiflora*; *bracteata*; *cylindrica*; *deserti*; *grandis*; *longiflora*; *patula*; *Pearsonii*; *rhodesiana*; *Stuckyi*; *subspicata*; *sulcata*; *Thunbergii*; *thyrsoflora*), with those which grow on the high mountains of tropical Africa (*Volkenii*), etc.

1143 - The "Luc-binh" Plant, utilisable as a Textile and for Paper Making, in the Far East. See No. 1109 of this Review.

1144 - Bamboos at Tonkin, used in Paper Manufacture. — CHIVATIER, AUG., in the *Bulletin agricole de l'Institut Scientifique de Saigon* Year I, No. 6, pp. 188-190. Saigon, June, 1919.

The manufacture of paper has given rise to a very interesting industry in Tonkin. This industry is of especial interest as it utilises a raw material very abundant in Indo-China, namely, bamboos. But the production is unlimited, and henceforth it is necessary to consider the industry as a whole, the storage, and the export trade, before dealing with still larger quantities. Two paper mills, one at Dapeau, the other at Vietri, have been working for the last two years, and the former will in a short time be capable of producing 150 tons of paper per month, and the latter, 250 tons.

The author (Director of the "Institut Scientifique de Saigon, Cochinchine") wished to discover the species chiefly employed, and his collaborator, M. F. FLEURY, took the matter in hand some months ago. The plants, which it has not been possible to identify scientifically, through lack of botanical materials, are found chiefly in tropical and sub-tropical regions, and are very numerous.

In 1913, according to the monograph by E. G. CAMUS, the number of recognised species exceeded 485; in 1896, J. S. GAMBLE described 180 species indigenous to India only.

In Indo-China, apart from certain species studied by BALANSA, very little is yet known. Until now, only lists of local popular names have been made which unfortunately have no documentary value. M. CAMUS enumerates 30 species, classified botanically, and which are found in Indo-China or in the neighbouring countries, but these are dealt with very briefly, and their number will some day probably be tripled or quadrupled. These studies were interrupted by the death of M. CAMUS, and the author has applied himself to the investigation of Indo Chinese bamboos. Unfortunately, owing to the scarcity of bamboo-flowers, the information has been difficult to collect. With regard to utilisation for paper-making, after numerous trials many species had to be discarded, particularly spiny bamboos, those with solid culms (males), those with closely-set, well-developed node, and dwarf species.

According to M. FLEURY, only varieties that are hollow and with long internodes can be utilised for paper manufacture. These are called by Europeans female bamboos and by the Annamites, "Nuà". The male bamboos have too many nodes and are too solid.

Three species are employed at the Vietri mill: —

1) "Nu-à-dai" — Large culmed, very thick; this is rarely used as the price is high and the natives use it for other purposes; the cost is \$1.50 per 100 kg.

(2) "Nu-à-bay" — Of average hollowness; the variety chiefly employed and of best value; the cost is \$0.65 per 100 kg; the natives sell the bamboo in bundles of 7 (7 = "bay" locally, hence, the popular name).

(3) "Nu-à-tep" — Small culmed, well set, maximum diameter 2 cm. Cost \$0.20 per 100 kg.

All these species grow in fairly large quantities in the neighbourhood of Fleuve Rouge and its tributaries, in the provinces of Tuy ên-Quang and of Xín-bay. This author thinks that they belong to the genus *Bambusa* and *Dendrocalamus*.

Transport is effected by means of the "sampan" to the Vietri mill, which is situated on the river bank.

It is evident that these wild species will become more and more rare if they are used indefinitely without taking steps towards reproduction.

A biological study should be made as soon as possible, to discover how they can be reproduced and the type of soil and treatment best adapted to their growth.

PLANTS

YIELDING OILS,
DYES, TANNINS
ETC.

SUGAR CROPS

1145 — African "Da" Hemp (*Hibiscus cannabinus*) as an Oil-producing Plant.
— See No 1140 of this Review.

1146 — Possibilities of Growing Sugar Cane in Morocco. — RIGOTARD, L., in *Journal d'Agriculture Pratique*, Year I, XXXIII, New-Series, Vol. XXXII, No 20, pp. 591-592. Paris, August 21, 1910.

Morocco appears to be a country that might be suitable for sugar-cane growing on a certain scale. As this crop has already been grown in the

past and climatic conditions seem favourable it is advisable that serious attempts should be made. The writer points out the advantages of such a crop and the useful purpose to be served by initiating trials to be carried out by the farmers co-operating with the official agricultural boards and with the agricultural experiment stations.

1147 - Cultivation and Value of the Wormwood used in the Manufacture of Vermouth.

— *Bollettino dell'Associazione italiana Pro Piante medicinali, aromatiche ed altre utili*, Year II, No. 7. pp. 97-100. Milan, July, 1919.

To flavour vermouth three species of *Artemisia* are used, along with many other substances: mountain wormwood (*A. vallesiaca*), small wormwood (*A. pontica*), and common wormwood (*A. absinthium*). The quantities of flower cymes absorbed annually by the Italian vermouth industry are, respectively for the 3 species: 3 to 4 tons, 8 tons, 20-30 tons.

The *A. vallesiaca* grows on the dry slopes of the central part of the Aosta Valley, at 600-1000 metres, and in Switzerland in the Valais district. Indiscriminate picking has caused it almost to disappear from Italy. It is grown from seed, the fruit sets at the end of October and the fallen seeds germinate on the spot the following spring. Hence, once sown, plants continue to grow for several years.

A. pontica is native to central and western Europe and the Caucasus. It is perennial. In Italy it is at present grown to a slight extent everywhere but not in sufficient quantities for the country's consumption. It grows on all soils, both on the mountains and on the plains. It is propagated by stocks, in lines, and benefits greatly by manuring.

A. absinthium is most used but also of lowest rank. It is fairly common in the mountainous districts all over Italy, even above 1500 metres. It succeeds well on light soil exposed to the sun, and is propagated by seedling and still better by suckers in spring. The seed keeps its germinating power for years. The plant is perennial, but should be protected from the rigours of winter.

In addition, *A. vulgaris* is common in Italy, growing wild everywhere and largely used in popular medicines, *A. maritima* occurs all over Italy, especially in Tuscany. These are exported to France and used there to denature cattle salt, making it more appetising.

1148 - Opium Poppy Cultivation Experiments in the Colonial Gardens at Palermo.

— LAZZARO, C., in *Bollettino di Studi ed Informazioni del R Giardino coloniale di Palermo*, Vol. IV, Nos. 3-4, pp. 219-221. Palermo, 1919.

A trial plot of *Papaver somniferum* was made in 1917 and 1918 for the production of opium, in the Palermo Colonial Gardens. Three seedings were carried out in 1917, — on October 15, November 15 and December 15. Flowering took place on April, 14, 24 and 30 respectively. Tapping was started 10 days after flowering, in the afternoons, and latex was collected in the mornings at sunrise. On the average about 1 kg. of opium was obtained from every 10.91 ares. Outwardly the opium appeared to be of good quality and contained 13.7 % morphine. It was therefore very rich in alkaloid, as the opiums of Smyrna and Constantinople contain 8 to 12 %, while those of Persia, Egypt, India, etc. contain still less.

1149 - **Composition of Mexican Cinchona Bark.** — *La Revista agricola*, Vol. IV, Nos. 5 and 6, p. 223. Mexico, May 1, 1919.

Analyses, made by Prof. V. CASTELLANOS QUINTEROS, of samples of bark of red cinchona collected in Cordoba (State of Vera Cruz), gave the following results, in %: Total alkaloids 5.133, including: quinine 2.108 cinchonidin 0.060, quinidine 0.015, cinchonin 1.912, unestimated alkaloids 1.037. These barks were not gathered at the period when they are richest in alkaloids, viz, shortly before flowering time. Hence the Mexican product surpasses all the more the South American, which contains 4 to 5 % alkaloids, and it bears comparison with grey cinchona, which contains 5-6 %.

1150 - **Growing of Digitalis (*Digitalis purpurea*).** — KOCH, G., and RUSSELL BUTLER, J., in *American Journal of Pharmacy*, Vol. XCI, p. 211, 1919; summarised in *Journal de Pharmacie et de Chimie*, Year III, Series 7, Vol. XV, No. 3, pp. 91-92. Paris, August 1, 1919

The blotting paper method gives good results in determining the vitality of digitalis seeds. To obtain digitalis plants under glass, the most economic method consists in sowing the seed directly in small pots; when the plants are 2 inches high, 3 or 5 plants are left per pot and let grow several weeks before transplanting to the open.

Inorganic fertilisers increase the yield of digitalis on clay soils. The fertiliser giving the best result was a complete one containing 10 kg. carbonate of lime, 8 kg. mono-calcium phosphate, 4 kg. sulphate of potash, 6 kg. nitrate of soda, 1 kg. sulphate of magnesia.

Nitrate of soda appears to be the most active constituent. For crops on sandy soil, mono-basic phosphate of lime is the fertiliser necessary. Neither sulphate of magnesia nor ferrous sulphate appear to increase the growth of digitalis, though the former may intensify the action of the digitalis.

1151 - **The Insecticidal Properties of *Pyrethrum cinerariaefolium* grown at Florence compared with those of other Asteraceae.** — PASSERINI, N. in *Nuovo Giornale botanico italiano*, Vol. XXVI, No. 1, pp. 30-45. Sancesclano Val di Pesa, Jan., 1919.

During the last few years the growing of feverfew (*Pyrethrum cinerariaefolium*) has been tried in several parts of Italy. The results have generally been good as to the growth of the plant and production of flower heads, but the insecticidal properties of the powder made from these have still to be confirmed.

At Florence, the feverfew grew as luxuriantly in the deep cool soil of the plain (Botanic Garden of the Forestry Institute), as in limy, very dry and hilly soil (Orchard of the Scandicci Agricultural Institute). The flower heads (still at the button stage) used by the writer were from the Forestry Institute's crop. They were ground down, sifted and kept in glass vessels. The other aster flowers tried at the same time were treated in the same manner. The kinds of insects used in the inquiry were:— the common fly (*Musca domestica*), dog flea (*Ctenocephalus canis*) and the workers of a common species of ant (*Crematogaster scutellaris*). Five or ten insects of each species were put in of 200 cc. flasks; in each flask

1 decigram of powder was poured, slowly shaken up and kept under observation.

It was found that, of the Asteraceae tried, none equalled the feverfew (*P. cinerariaefolium*), both as regards intensity and rapidity of action. It is not only the flower heads of this plant which are effective against the 3 species of insects used, but also in less degree the leaves, stems and roots, the last being rather less effective than the others. The flowers, leaves, stems and roots of this plant, provided they are reduced to a fine powder, infallibly kill the insects chosen for the experiment; the difference is in the time required.

Among the Italian Asteraceae the following, in order of decreasing efficiency, had a fairly marked effect: *P. Achilleae*, *P. Parthenium* and *P. corymbosum*.

Dog fleas are destroyed, in a longer time, by the powder of the flowers of *Chrysanthemum Myconis*, *Anthemis tinctoria*, *A. Cota*, *Matricaria Chamomilla* and *Santolina Chamaecyparissus*. On the other hand these powders have no effect on flies. Of the *Cremotogaster*, some are also inactive, while others are of slight efficiency. The action of *Pulicaria dysenterica* was uncertain.

Powders of *Chrysanthemum indicum* (flowers and leaves), *Aster tripolum*, *A. Linosyris*, *Inula viscosa* and *Thymus tuberosus* (flowers and roots) are quite inactive (1).

(1) In the *American Journal of Pharmacy*, Vol. XCI, pp. 25 and 91, 1919, Mr R. C. ROARTH gives a list of 180 plants which, according to the authors from whom he collected his information, possess insecticidal properties. Some of the commonest, arranged in alphabetical order, are the following: *Asanthus glandulosa*: caterpillars crawling up this tree soon fall off paralysed and die — *Amanita muscaria* used for several centuries against flies — *Anthemis Cotula* and *A. nobilis*: the flower heads dried and powdered possess properties similar to those of feverfew: *Delphinium Consolida*: an alcoholic tincture of the seed has been successfully used against lice — *D. Staphysaria*: PLINY mentions the use of powder made of its seeds against lice — *Eucalyptus Globulus*: the branches clear houses of mosquitos — *Euonymus europaeus* and *E. atropurpureus*: the seeds are used against lice — *Juglans nigra*: a decoction of leaves applied to the hides of horses and other animals protects them from fly and other insect stings; the same decoction sprayed on cotton plant leaves protects them from being eaten by insects — *Linaria vulgaris*: the juice of the plant mixed with milk gives a liquid fatal to flies — *Linum usitatissimum*: linseed oil, applied to the skin, kills all parasites — *Lycoperdon Bovista*: when ripe is used in England to stupefy bees — *Lycopersicon esculentum*: the leaves, placed around fruit trees, keep insects away — *Lysimachia nummularia*: an infusion in the oil of leaves and flowers destroys insects and larvae infesting granaries — *Nerium Oleander*: the bark is used to destroy rats and insects — *Nicotiana Tabacum*: the extract is well known as an insecticide — *Rhinanthus Crista-galli*: regarded as insecticide — *Ricinus communis*: the leaves contain a substance fatal to flies and other insects — *Rosmarinus officinalis*: the branches keep moths from clothes — *Sambucus nigra*: the leaves kill several species of insect pests — *Tamox communis*: the root powdered has been recommended for destroying lice on childrens' heads — *Tanacetum vulgare*: the flowers have a stupefying effect on insects: in the north of England tansy powder is sold as a substitute for feverfew powder — *Tropaeolum majus*: planted near apple trees, it prevents parasites from attacking them — *Veratrum album* and *V. viride*: the rhizomes and roots when pulverised are used as an insecticide — *Journal de Pharmacie et de Chimie*, Year III, Series 7, Vol. 19, No. 3, pp. 309-311. May 1, 1919 (Ed.)

and earlier ripening. HUSMANN also believes that grafting increases fruitfulness, the temporary obstruction seeming to have the effect upon the graft of making it produce more and finer fruit than on its own roots.

The author, considering the matter to be worthy of investigation, undertook experiments to throw light on the problem, in his plantations at Nasik (Bombay Presidency)

Only four varieties of grapes are grown at Nasik: — Bhokari, a good cropper, much in favour and largely grown, Fakari, Sahibi and Hafsi or Kali, very vigorous growers, producing abundant foliage, but very shy bearers, less widely grown and with few vines in a plantation, though these varieties are decidedly superior. If grafting produced increased fruitfulness the problem, according to the author, was to ascertain whether some of these shy bearers could be made to yield more and better fruit by grafting them on other stock.

The author thought that Bhokari, being very prolific, might exert a favourable influence upon the scion. Also as Takari, Sahibi and Kali are very vigorous growers, producing abundant foliage — perhaps at the expense of fruit — he thought he should be able to check this habit of vigorous growth by selecting a stock which was a moderate grower by habit, such as Bhokari. On these considerations he made experiments using Bhokari as stock.

From these experiments it appears that grafting the grape-vine does increase fruitfulness. The grafts give larger and closely set bunches. In some bunches the berries attain normal size, while in others they are undersized. The quality of the fruit is not changed appreciably. The experiments were not conducted on a large enough scale to support the assertion, as a general proposition, that grafting produces fruitfulness, but the indications are that it does produce increased fruitfulness. More experimental work is necessary to establish the facts and the author intends to continue such work next season.

1157 — **Italian Varieties of Chestnuts.** — VIGANI, D., in *Le Stazioni sperimentali agricole italiane*, Vol. LII, Nos 5-6, pp 266-277. Modena, 1919

The author observed that the chestnut tree could be greatly improved by systematic selection, whereas local types exclusively are multiplied persistently. For selection work it is of advantage to be able to have an exact and sufficient classification. After summarising and criticising those of TRICAUD, PASSIRINI, COMELLI, BAGLIONI, RICCI, and LAVIAIE, and noting that the fruiting varieties may be divided into 4 groups. — 1) for the production of first class chestnuts (early and late); 2) for ordinary consumption (commercial) 3) for flour (of large yield), 4) for farm stock feeding; the author gives his classification based on the form of the fruit, as follows: —

- | | |
|---|---|
| GROUP I: Oval nuts (greater length than breadth). | { Section 1: Flat base (e. g. marron). |
| | { Section 2: Conical apex (e. g. Grossala). |
| GROUP II: Rounded nuts (3 dimensions equal) | { Section 3: Flat apex (e. g. Iuccichente). |
| | { Section 4: Conical apex (e. g. Raggiolana). |

GROUP III: Oblong nuts (depth greater than length, not counting the remains of the style.	Section 5: Rigid and sharp apex (e. g. Domestica).
	Section 6: Rounded apex (e. g. Pistolese).

In this way the 74 Italian varieties of chestnuts would be classified as under:

GROUP I: OVAL CHESTNUTS.

Section 1: Flat-apex nuts:—

1. Marrone (Casentino); 2. Carrarese (Pistoia and Lucca Appennines); 3. Marrone Pazzo (Monte Amiata); 4. Sarvalet (Mondovi); 5. Frattona (Mondovi); 6. Ciria (Piedmont); 7. Rossarina (Mondovi); 8. Marrone di Antrodoco (Prov. of Aquila); 9. Ruena (Mondovi); 10. Spina lunga (Mondovi); 11. Gentile Colombo (Cuneo); 12. Gentile Verdais (Mondovi); 13. Marrone di Garoglio (Cuneo); 14. Neiranda (Turin); 15. Rossola (Bologna-Pistoia); 16. Fragonese (Casentino); 17. Marrone fiorentino (Monti Cimini); 18. Pelosello (Monti Cimini); 19. Lojola (Porretta-Lizzano); 20. Biancarina (Bologna).

Section 2: Conical-apex nuts:

21. Grossaia (Lucca-Pistoia); 22. Pastinese (Pistoia, Monte Amiata, Lucca, Romagna); 23. Vitarina (Montagna Cortonese); 24. Pastorese (Montagna Cortonese); 25. Brandigliano (Pistoia); 26. Patac (Upper Valley of Ellero); 27. Bastera (Mondovi); 28. Giapastra (Piedmont); 29. Nari (Mondovi); 30. Crovi (Cuneo); 31. Gentil nero (Mondovi); 32. Gentil rosso (Mondovi); 33. Marrone di Chiusa Pesio (Maritime Alps); 34. Riare (Cuneo); 35. Grossolana (Granaglione).

GROUP II: ROUNDED CHESTNUTS.

Section 3: Flat-apex nuts:

36. Mogliana (Pistoia); 37. Luccichente (Monte Amiata); 38. Giugiolana (Mugello); 39. Luciani (Monti Cimini); 40. Lizzanese (Romagna); 41. Pelose (Mondovi); 42. Ballotta (Tuscan Appennines); 43. Sanmartine (Tuscan Appennines); 44. Cornere (Cuneo); 45. Sarvai di Buia (Mondovi); 46. Gabbiana (Mondovi); 47. Cite (Turin); 48. Morettina (Civitella di Forlì); 49. Selvatica Marronata (Casigna Romagna).

Section 4: Conical-apex nuts:—

50. Reggiolana (Casentino, Mugello, Romagna); 51. Roggiolano (Montagna Cortonese); 52. Culabianca (Piancastagnaio-Amiata); 53. Lucchese (Piancastagnaio Amiata); 54. Bastardo rosso (Monte Amiata); 55. Romagnolo (Pistoia); 56. Buttala (Mondovi); 57. Ceppa (Emilia); 58. Marrone di Napoli; 59. Biancola (Bologna); 60. Borgarola (Emilia); 61. Bustana (Emilia); 62. Bastarda (Emilia); 63. Nerattina (Emilia); 64. Pelosa (Emilia); 65. Moretta (Emilia).

Section: 5 Rigid and sharp-apex nuts:—

66. Domestica (Monte Amiata); 67. Frombola (Emilia-Pistoia); 68. Rossa (Upper Valley of Tanaro, Mondovi); 69. Fusera (Mondovi); 70. Borga (Mondovi); 71. Gaggia (Mondovi); 72. Spicchio d'Aglio (Mondovi); 73. Primaticcia (Mondovi).

in conversion at 33 $\frac{1}{4}$ per cent., it would give a total of 865 000 000 s. feet for 8 years, or an annual average total consumption of 108 000 000 superficial feet (approximately)

If the rate of consumption is maintained at this average, and if the remaining supplies of white pine are all available for milling, they will last another nine years. Even if the consumption is taken at the estimate supplies by the Lands Department — viz., 92 000 000 superficial feet — the white-pine reserves will be exhausted in a little over 10 years. The position is, therefore serious and the dairying industry is justified in focussing attention on a matter that so vitally affects its interests.

The following recommendations have been submitted to the Government. —

- 1) That the Government should determine without delay what its policy in regard to forestry generally is to be, as is it impracticable to pursue in regard to white pine a policy different from that applied to the other timbers of New Zealand. If the Government determines upon a policy of scientific conservation and afforestation, a course which the Board strongly recommends, no time should be lost in giving effect to such decision. Until the Government's decision be arrived at, it is recommended that the various Commissioners of Crown lands should meet periodically and decide on a policy to be pursued in regard to leasing, or withholding from sale or lease the remaining blocks of timber on Crown lands.
- 2) That the Duty Division of the Agricultural Department be requested to make exhaustive tests with various native and imported woods with a view to determining their suitability as substitutes for white pine butter boxes.
- 3) That a bonus be offered for a suitable substitute manufactured at reasonable price.
- 4) That all differential treatment of white pine in the matter of freights on railways should be removed. This would mean an increase in the freight rates now paid on white pine.
- 5) That the Australian Government be approached with a view to re-arrangement of its import duties on New Zealand timbers, in order that the differential treatment accorded to white pine should be removed and other New Zealand timbers be placed on an equality with it.

Further urgent representation have been made by interested parties for the absolute prohibition of the export of white-pine timber, so as to conserve existing supplies for New Zealand's sole use, and regulations have been gizzetted having for their object the control of the export trade, the fixing of prices for timber for local use, and the gradual diminution of exports to prevent the depletion and utter exhaustion of the New Zealand forests.

1160 — **Researches on some Conifers in the Rocky Mountains, U. S. A.** — SUDWORTH, G. B. (Dendrologist), in U. S. Department of Agriculture Bulletin No. 680, *Contribution from the Forest Serv., Profess. Paper*, 45 pp., 13 pl., 9 maps. Washington, 1918.

A dendrological study of the Tamarack larch = *Larix laricina* (Du Roi), Kock, western Larch = *Larix occidentalis* Nuttall, alpine larch = *Larix lyallii* Parlatores, and other forest species of the Rocky Mountains. Western hemlock — *Tsuga heterophylla* (Raf) Sargent, mountain hemlock — *Tsuga Mertensiana* (Bong) Sargent, Douglas fir = *Pseudotsuga taxifolia* (Poir) Britton, Incense cedar = *Libocedrus decurrens* Torrey; western red cedar — *Thuja plicata* D. Don, western yew — *Taxus bre-*

myrtia Nuttall. The characteristics, families, forest habitat and geographic distribution of these plants are indicated, with an analytic key to the genera and species. An appendix gives the publications issued on the subject by the U. S. Department of Agriculture.

1161 - **For the Development of the Cork Industry in Portugal.** — *Diário do Governo*, I s., No 186, p. 1559 Lisbon, August 26, 1918

Decree No. 4745 of August 20, 1918, provides that the following facilities and premiums shall be allowed to factories already existing or which will be set up in the future in Portugal with the intention of developing there the cork industry, while specialising in the growth of products having the greatest commercial value —

Exemption from import duties of machines and implements intended for cork working.

Free grant of land belonging to the State for the installation of factories intended for cork working.

Production bonus at the rate of 1 to 5 *mils* (5.60 francs *at tax*) per ton of cork treated, to be divided up in proportion to the commercial value of the products manufactured.

Bonuses of merit to the concessionaires of patents for new uses for cork or patents in new industries in relation to the progress of the cork industry.

Export bonuses to be fixed per ton of cork worked up, in proportion to the commercial value of the products exported.

Reduction of 20 % on the rates for land and sea transport controlled by the State

Reduction of 20 % on the storage rates in the warehouses of all the seaports of the continent.

1162 - **Experiments in Afforestation in Morocco.** — MAIN, F., in *Journal d'Agriculture pratique*, Year LXXXIII, New Series, Vol XXXII, No 27, pp 548-549 Paris, Aug 7, 1919

Except for the important forest blocks near the Atlas mountains and even in the heart of the mountains, up to the present almost the only shrub vegetation known in Morocco was the Mamora and Zaërs stands of cork trees and the forest (if it may be called so) of iron wood in the Mogador district (1). Everywhere else the Arabs on one hand and wild animals on the other had soon made every trace of trees disappear, and the greater part of Morocco known until the last few years had a characteristic denuded appearance.

Since 1912 the author began, first in Chaouïa and then in the Sebu district, to establish nurseries of various species to find out which had a rapid growth and was suitable for partial afforestation. He has not been able to follow the trials made in Chaouïa, almost entirely on eucalyptus, but on

(1) As regards the forest resources of Morocco, especially cork oaks, etc., see R., April, 1919, No. 475. (Ed.).

the other hand he has now precise data on those carried out in the Sebu region which are beginning to get beyond the experimental stage

The eucalyptus, chiefly on account of its rapid growth on fresh soils, has had first preference. The author at present has round one of his farms a small eucalyptus wood of fine growth. The following species have been tried *Eucalyptus Globulus*, *E. rostrata*, *E. viminalis*, *E. amygdalina*, *E. robusta*, *E. citriodora*, and *E. corvinalyx*.

The *E. rostrata* is the one which appears to thrive far best on the banks of the stream where it was planted. Seedlings made in 1913 transplanted in 1914 gave in 1915 trees over a dozen yards high and measuring 25 to 26 inches in circumference at $3\frac{1}{2}$ ft. from the ground.

E. Globulus came on well but seems to grow more slowly. Of the *E. robusta* only some plants survived, they are, however, of good appearance. *E. viminalis* is represented by a few specimens only, of much smaller girth at the same age. There is nothing to be remarked about the others, whose growth is average.

The author did not get good results with bamboos (*Phyllostachys mutis*, *Bambusa macrocalamus*, *Phyll. aurea*), but he expects to make a new trial next autumn.

The poplar (*Populus alba*) is almost indigenous to Morocco, but it does not appear that the specimens studied by the author grew very quickly. The ash (*Fraxinus excelsior*) grows well. The tan arind, various acacias (*Acacia lophantha* and *A. floribunda* chiefly), *Myoporum putum* and the carob, all native or long acclimatised, grow admirably without any special care.

Of the conifers, several trials were made but in general they were not very remarkable. There is no longer trace of *Sequoia sempervirens* and *Pinus insignis*, but the juniper (*Juniperus virginiana*) and cypress (*Cupressus horizontalis*) survived well and promise to develop normally.

The writer hopes his example will be followed and Morocco will be re-afforested as much as possible.

1163 Canadian Resources in Pulp Wood *The Board of Trade Journal* Vol C (N S), No 1118, p 542 London, 1918

According to a paper read by the Director of the Dominion Forestry Branch to the Technical Section of the Canadian Pulp and Paper Association in March, the Canadian forests, being of northern types, include a large proportion of conifers and in the forest east of the Rocky Mountains there is a special predominance of spruce and balsam fir. This predominance is shown from the fact that spruce and balsam fir form over ninety per cent of the pulp wood cut in Canada, and that they form forty-five per cent of the cut of lumber. The species used in the making of pulp and paper in Canada are spruce, balsam fir, hemlock, jack pine, poplar and tamarack.

Spruce — The Canadian spruces include five species. Red spruce (*Picea rubra*), white spruce (*P. canadensis*), black spruce (*P. mariana*), Engelmann spruce (*P. Engelmanni*), and Sitka spruce (*P. sitchensis*). The first three named are the species found in Eastern Canada and the last two are found in British Columbia.

The black and the red spruces are found from Nova Scotia westward into Quebec almost to the border of Ontario and the white and the black spruces through northern Quebec, Ontario and the prairie provinces to the Rocky Mountains. In general, these species are not differentiated in the manufacture of pulp and paper but black spruce is heavier than white and gives a greater yield of pulp per cord. There is marked difference between trees grown on well drained soils and those grown in the undrained muskegs, black spruce being the species which is generally found in the latter conditions.

Engelmann spruce resembles white spruce very closely and is differentiated mainly by botanical characteristics or those influenced by climate. Sitka spruce is a coast species and is found in a belt exceeding thirty to forty miles in width on the Pacific Coast of British Columbia. It is the largest in size of the Canadian spruces, being found up to sixty inches in diameter. The large clear timber required for aeroplane manufacture can best be obtained from this species and it is now being used for this purpose and may possibly be retained largely for such use in the future.

The other spruces on well drained soils may reach twenty-four to thirty-six inches in diameter but would more generally average between ten and eighteen inches in diameter and from seventy to eighty feet in height. In the muskegs or poorly drained lands the diameter rarely exceeds nine inches.

The spruces are particularly well adapted for pulp and paper making, the colour of the wood being white and the fibre a suitable length. The average length of the fibre in spruce is three millimetres. Spruce contains less resin than any other conifer and such as there is not in sufficient quantity to present any difficulty in the process of manufacture.

Fir. — Balsam fir is represented in Canada by four species: Eastern fir (*Abies balsamea*); lowland fir (*A. grandis*); amabilis fir (*A. amabilis*); and mountain fir (*A. lasiocarpa*). The first species is the only one found in Eastern Canada and its range is westward to the Yukon. The other species occur only in British Columbia. The eastern species is used largely for the making of pulp and paper and is now accepted generally for the purpose with spruce. The colour of the wood is white, the fibre length almost equal to that of spruce, but the resin content is greater than in spruce and is of a more troublesome character.

Hemlock. — There are two species of hemlock in Canada; the eastern hemlock (*Tsuga canadensis*) and the western hemlock (*T. heterophylla*). The former is found in eastern Canada but has not a far northern range. Hemlock forms only 4 to 7 per cent. of the wood used for pulp making in Canada. It is, however, much more largely used in the United States, forming fourteen per cent. of the quantity of pulp-wood used and ranking next to spruce. As far as the qualities of the fibre are concerned, hemlock is well suited for the making of pulp, but the dark-coloured wood requires more intensive bleaching treatment. It is especially suitable for coloured wrappings.

Pine. — Jack pine (*Pinus Banksiana*) is used in small quantity by pulp mills. Its range is the whole of the northern part of Canada, and it is generally found on light, sandy lands. Its fibre is of about the same length as that of balsam fir. It has a much larger amount of resin and so requires an alkaline treatment (sulphate process instead of the acid sulphite). It is very suitable for kraft papers. With the development of the practice of the chipping and baling of pulp wood for sale jack pine should be used much more extensively, as it can be produced in this form in large quantities as a by-product of the sawn tie industry.

Poplar. — Aspen poplar (*Populus tremuloides*) was the first wood used for paper making, but although it is perhaps the most widely spread species in Canada, it is used to a very small extent. The difficulty of transport owing to the wood not being readily floatable, and the shortness of the fibre, which affects the strength of the paper, prevent a more extensive use of this wood under present conditions.

Hardwoods. — Of the hardwoods none are at present being used in Canada for pulp making, and the only ones which occur in sufficient quantity to make their use a possible factor of any importance are birch, maple and beech. The wood of all of them is short-fibred,

however, and it is probable that they will be found more valuable for other uses. In the United States these three species form little over 1 per cent of the total wood consumed for the making of pulp.

Types of Forest — The forest of the Maritime Provinces and of the Province of Quebec south of the St. Lawrence River, are placed in a type designated Acadian. It is generally a mixed type of hardwood and conifers, the principal hardwoods being birch, beech and maple, and the conifers red and white spruce and balsam fir. White pine at one time formed a considerable part of the stand, but now forms only a minor part. On the higher locations the type becomes purely coniferous, as, for instance, in the Gaspé peninsula.

Along the St. Lawrence River is a type now mainly composed of hardwoods which it is not necessary to consider from the present point of view. The Laurentian type covers most of the southern watershed of the Laurentian formation in Ontario and Quebec, and is the great timber area of eastern Canada. This type includes a mixture of hardwoods and coniferous species, with the hardwoods decreasing going northwards until almost pure coniferous forests are found. The great white pine timber belt of Canada is in this region, and in it is also the largest area of spruce lands and the greatest development of pulp production.

North of the Laurentian type lies a tract stretching from the Atlantic to the Pacific, designated the sub-Arctic type, which is further divided into a southern and northern. This is a type composed of black and white spruce, balsam fir, jack pine, tamarack and poplar, but in the northern division the balsam fir disappears. As the Rocky Mountains are reached and westward, jack pine is replaced by lodgepole pine, and balsam fir by mountain fir.

Types in British Columbia. — In British Columbia there is greater variety in species, and a number of types may be distinguished. The southern mountain type and the coast type are the most important.

The coast type includes a strip along the Pacific Coast not more than fifty miles in width, except near the southern boundary of the Provinces, and in this strip the big timbers are found. The chief species are the Douglas fir, western hemlock and cedar (*Thuja plicata*), which reach a magnificent development. Mingled with these are giant fir, Sitka spruce, and cypress or yellow cedar. In the northern part on the coast strip the Sitka spruce gradually becomes more important, and is found in almost pure stands.

The mountain type comprises southern British Columbia and the Rocky Mountains south of about the 53rd degree of north latitude. It includes western yellow pine, western white pine, Engelmann spruce and western larch, with an intermingling of Douglas fir, cedar, hemlock, and lodgepole pine.

1164 — **Utilisation of the Steppes of Tripoli for Afforestation.** — See No. 1088 of this Review.

LIVE STOCK AND BREEDING.

1165 - **A Study of the Different Forms of Babesiosis in the Netherlands.** — VRYBURG, A. (Veertsenykundige Hoogeschool te Utrecht), in *Tydschrift voor Diergeneeskunde*, Vol. 43, Part 19, pp. 535-549, 4 plates. The Hague, October 1, 1918.

A detailed study of the different forms of babesiosis, and of the varieties of *Babesia* found in the Netherlands. After giving a morphological description of the ticks, which are the agents transmitting the parasites, the writer mentions the different known forms of *Babesia*.

Except in the cases of the horse and donkey, which are attacked by the same parasite, the forms infesting different species of animals are not identical.

It had been long believed that the kinds of *Babesia* met with in cattle belonged to the same species, but the researches of THEILER have revealed the presence of different forms of these parasites: In the first place, there is a *Babesia* found in South Africa and the Netherlands, which is known by the name of *Babesia mutans*, and occurs usually in the form of a comma or of a rounded rod, and in the second there are two other forms of *Babesia* differing in shape and size, but which both attack cattle.

The larger of these forms is *B. bigemina*; it was found by SMITH and KILBORNE in North America, and is the parasite producing Texas fever. It is also known in South America, South Africa, Australia, India, Japan and the United Kingdom.

The smaller form, *B. bovis*, might be called the European type, since it produces most of the babesioses observed in Europe.

In the Caucasus, DSCHUNKOWSKY and LUKS, found several forms of *Babesia*, and gave the name *Piroplasma annulatum* to the most important. The plates accompanying these writers' works, however, depict parasites that in some instances closely resemble *B. bovis*, whereas in others they are like *B. mutans*, therefore it is probable that we have to do in this case with a complex infection.

In Argentina, LIGNIÈRES observed in addition to *B. bigemina*, a much smaller parasite, to which he gave the name of *Piroplasma argentina*, but it is probable that the latter is identical with *B. bovis*. In the United Kingdom, *B. bigemina* is chiefly met with.

In 1911, MAC FADYEAN and STOCKMAN described a new *Piroplasma* infecting cattle in the United Kingdom. It is smaller and thinner than *B. bigemina*, and usually assumes a twinned form. The above-mentioned investigators gave to this *Piroplasma* the name of *Babesia divergens*, and succeeded in proving, by means of successive injections of *B. bigemina* and *B. divergens*, that the infections due to these parasites do not confer reciprocal immunity, and therefore that these two forms are certainly distinct. The author, however, is convinced that *B. divergens* is the same as *B. bovis*, which also differs from *B. bigemina*, as has been shown by all the investigations connected with the subject (1).

(1) Recently, SOLMS observed in the Dutch Netherlands a *Babesia* which he identified as *B. bovis* and *B. divergens* but called *Microbabesia divergens* in order to express its two chief characters: small size and divergent form. See R. March, 1919, No. 330. (Ed.)

The agents transmitting the two parasites are moreover very different. Texas fever (due to *B. bigemina*) is transmitted by *Boophilus annulatus*, and never by *Ixodes ricinus*.

Dr JONG, in the Netherlands, and KNUTH, in Germany, have described cases of babesiosis giving rise to rupture of the spleen (splenorrhæxia). These writers also believed it to be a new kind of parasite, and Dr JONG gave the microorganism the name of *B. rupturæ lienalis*.

VRYPBURG is, however, of opinion that there again it is a question of the same form, viz., *B. divergens* (1).

1166 - A Blood Destroying Substance in *Ascaris lumbricoides* (2). — SCHWARZ, B. (Zoological Division, Bureau of Animal Industry U.S. Department of Agriculture), in *Journal of Agricultural Research* Vol. XVI, No. 6 pp. 253-258, bibliography of 15 works. Washington March 3 1919

The view that parasitic worms secrete toxic substances which are absorbed by the host and which are responsible to a considerable extent for the symptoms which often accompany parasitic infections, has received strong support from experimental work with the body fluids and extracts of the various species of *Ascaris* that parasitise man and domesticated animals. That *Ascaris* may cause anæmia is the opinion of various observers. Certain investigators attribute hæmolytic properties to the body fluids of *Ascaris*, several other investigators, on the other hand, deny the presence of hæmolytic substances in *Ascaris* and state that blood corpuscles of the host in contact with extracts of the worms remain intact.

For some time past the author has been studying the problem of the possible absorption of toxic products by animals harbouring ascarids. In this work *A. lumbricoides* of swine has been utilised. The experiments, the results of which are summarised in this paper, were undertaken with a view of determining: — 1) whether the body fluids of the parasites are hæmolytic, 2) whether the excretions of the worms kept *in vitro* contain blood-destroying substances, and 3) the relation which may exist between the anæmia of ascariasis and the absorption by the host of toxic substances produced by the parasites.

The conclusions arrived at are as follows: —

The failure to demonstrate hæmolytic principles in the excretions of the worms when kept *in vitro* appears to favour the view that the hæmotoxic substances of *Ascaris* partake of the nature of endotoxins. There is also to be considered the possibility that the death of a worm in the intestine may be followed by a rapid disintegration of its tissues and the liberation of toxic substances before it passes out of the body of the host. TALLQVIST, in fact, has shown in the case of another parasite (*Dibothriocephalus latus*) that the toxic substances are liberated only when the worm disintegrates, which affords a possible explanation why *Dibothriocephalus* sometimes produces no ill effects on its host, whereas in other

(1) The author appears to be confirmed in his opinion by the fact that one of the symptoms of *divergentiosis* (the disease caused by *B. divergens*) is splenorrhæxia. (Ed.)

(2) See also *R. Sci. Invent.*, 1918, No. 1007. (Ed.)

instances a severe anæmia is present. The fact that in some cases human beings and other animals infested with ascarids remain in apparent good health while in other cases they show evidences of suffering from such infestation may perhaps be explained in much the same way as the differences observed in cases of infestation with *Dibothriocephalus*.

The inhibitory effect of the serum on the hæmolytic action of the body fluids and extracts of the worms appears to be a direct negation of the view that anæmia of animals harboring ascarids is due to the toxic secretions of the worms. It is necessary to remember, however, that a reaction *in vivo* may be very different from a reaction *in vitro*.

Apart from the question of anaemia as a result of the absorption of toxins produced by *Ascaris*, there is the question of anaemia as a result of the direct abstraction of blood by the parasite. The opinion that *Ascaris* is a bloodsucker has been expressed by SCHIMMELPFENNIG, who based his view largely on the fact that the body fluid of *Ascaris* contains oxyhaemoglobin, the source of which presumably is the blood of its host. The view that *Ascaris* may suck blood is also supported by the structure of the mouth parts of the parasite and the lesions observed in the mucosa of intestines of animals harbouring *Ascaris*.

The *Ascaris* is provided with strong chitinous lips, denticulated along their edges. That such a buccal armature could succeed in lacerating the smaller blood vessels of the intestines is by no means improbable. BLANCHARD states that there can be no doubt that *A. lumbricoides* bites the intestinal mucosa. GUIART has shown that *A. conocephala* is often firmly attached to the mucosa of its host; he also states that LEROUX found wounds in the intestinal mucosa of man resembling punctures which were apparently produced by *A. lumbricoides*. FRIEDBERGER and FRÖHNER state that the intestinal mucosa of dogs harboring ascarids often shows evidence of punctures.

The above observations, coupled with the presence of oxyhaemoglobin in the worms, a substance which apparently is constantly being excreted by the parasites (to judge from their behavior *in vitro*) and which consequently must be as constantly renewed, appear to favour the view that *Ascaris* probably supplements its food intake by sucking blood from time to time. The hæmolytic substance which is particularly abundant in the intestine of the worms apparently serves the purpose of liberating the oxyhaemoglobin from the corpuscles, some of which passes into the body fluid of the parasites. In this connection it should be recalled that *Ascaris* is rich in iron and that this substance enters in considerable quantity into the composition of the eggs (SCHIMMELPFENNIG). The significance of the oxyhaemoglobin in the body fluid of the worms is not well understood. Whether it merely represents a by-product in the metabolism of the worm and is always excreted as such, or whether it may also first be broken down into simpler compounds with the retention of some of the iron by the tissues of the parasite, still remains to be answered. Whether or not oxyhaemoglobin fulfills an important function in the life processes of the worm — perhaps in oxidation — is another question to be solved. In this connec-

tion it is interesting to observe that coincident with the disappearance of oxyhaemoglobin from the worms *in vitro* they become sluggish, and that their existence after the complete elimination of this substance is very brief.

1167 - **Osteoporosis or Osteomalacia of Equidae in the Belgian Congo.** — VAN SAGEGHEN, R. (Bacteriological Laboratory, Zambézi), in *Bulletin de la Société de Pathologie Exotique*, Vol. XII, No. 5, pp. 238-243. Paris, May 11, 1919.

Osteomalacia, or demineralisation of the bony tissues, is an affection characterised by disturbances of the calcareous metabolism with reabsorption of the salts entering into the composition of the bones. These become fragile and distorted. Osteomalacia is a disease attacking bovidae, equidae, suidae, ovidae, and even dogs and birds. The osteomalacia of equidae is known as osteoporosis, while lack of mineralisation in young animals goes by the name of rickets. Osteomalacia, osteoporosis and rickets have, therefore, certain specific symptoms in common, namely, general disturbances due to the mineralisation of the bones and the lesions resulting from this process. It is for this reason that the writer proposes the single term bony cachexia for the disease known as osteoporosis in horses and as rickets, or osteomalacia, according as to whether it attacks young or adult animals belonging to other families.

What are the causes of bony cachexia? Casein, a flexible and elastic albuminoid substance, which represents the chief constituent of bones, is unable to attain any stability unless it is supported by mineral salts, that is to say, unless young animals find in their food (in a form capable of being assimilated) the calcium and phosphorus necessary for building up their bones. In adult animals whose bones are already formed, want of phosphorus is of little importance, on the other hand, however, a deficiency of calcium necessarily brings about serious troubles in the bony tissue, in fact, in the circulating blood, calcium is found in the form of the acid carbonate; if calcium is wanting, it is probable that the calcium carbonate of the bones becomes transformed into acid carbonate, and the tricalcium phosphate into monocalcium phosphate. This purely chemical theory explains the demineralisation of the bones and the want of phosphorus regularly observed by the writer in the Congo in animals suffering from osteoporosis. Other writers have put forward various theories regarding the etiology of the disease; they think it is due to infection, and some, like COUREUR, are of opinion that *Cyclostomum tetracanthum*, a parasitic stronglyd, is the pathogenetic agent. The author has, however, observed many individuals attacked by parasites which had not the slightest sign of lesions produced by osteoporosis, but he admits that in the bone-tissue altered by cachexic lesions, parasites, or bacteria, are to be found, which while they are not the etiological cause of the evil, may nevertheless complicate it.

The writer's chemical theory is fully borne out by the observations made by him in the Belgian Congo, where the disease is very common.

all breeding Stations, where cases of osteoporosis have been found, the writer has been able to ascertain that the disease spares no species of equidae, but that horses seem to be more quickly attacked than donkeys. Animals always living in the stable, and those living at liberty in the brush-wood, are equally attacked ; further, the origin of the equidae introduced has no effect upon the evolution of the malady. All the animals were well-fed, being given maize, rice, Guinea grass, false sugar-cane, soya, etc. Wherever the disease was observed, however, chemical analysis proved that the soil of the region was poor in calcium and phosphorus, and, further, little or no calcium was to be found in the water. On the other hand, in all the districts where there was much calcium in the water, not a single case of osteoporosis was ever found. A proof that the etiological cause of this malady is lack of calcium, not only of the calcium fixed in different forms in food stuffs, but especially of the calcium in solution in drinking-water, has been established by the fact that the disease has been completely eradicated in a region where it existed under enzootic conditions, by giving horses water to drink which contains acid calcium carbonate in solution.

The writer suggests, in order to explain the fact that the bovidae, ovidae, etc., of the same region do not seem to suffer from the prevalent lack of calcium, that equidae must be more susceptible to want of lime than other animals.

1168 - **Note on the Bacillus of Epizootic Abortion in Mares, Experiments Made in Belgium.** -- BRUYNOGHE, R. (University of Louvain), in *Comptes Rendus des Seances de la Societe de Biologie* (Meeting of the Belgian Biological Society), Vol. LXXXII, No. 23, pp 954-955 Paris, July 19, 1919

The study of cultures obtained by inoculating gelatine with the foetal products expelled by female donkeys suffering from epizootic abortion enabled the writer to establish the fact that all the different lines of bacteria observed had the same characters and belonged to a single variety, namely to a variety of the paratyphic bacillus B. On consulting the literature on the subject, the author found that LIGNIERES, DE JOUY, and VAN HEELSBERGER had described a similar bacillus as the cause of epizootic abortion in mares. In order to decide the connection existing between the microorganism isolated from the donkey and that obtained from the mare, the writer subjected the two bacilli in question to the agglutination test. He prepared the agglutinin by injecting a rabbit with dead bacteria isolated in the Congo. These experiments enabled him to establish the identity of the two lines of bacilli. The microorganisms producing contagious abortion, in mares, which had been isolated on the spot, were agglutinated to the same extent as the bacilli used in the preparation of the serum. This proves the identity of the pathogenetic agent affecting asses and mares. The bacillus occasioning contagious abortion in donkeys had not been isolated before.

- 1169 ***Bacterium abortus* Infection of Bulls** (1). — BUCK, S. M., CREECH, G. T. and LADSON, H. H. (Pathological Division, Bureau of Animal Industry, U. S. Department of Agric.), in *Journal of Agricultural Research*, Vol. XVII, No. 5, pp. 239-246 Washington, D. C., August 15, 1919

Numerous investigators have called attention to the fact that *Bacterium abortus* agglutinins and complement-fixing bodies can frequently be demonstrated in the blood serum of bulls from abortion-infected herds. Such animals in consequence have frequently been referred to as being systematically infected. While the presence of these bodies constitutes strong evidence that abortion infection exists, or has been present, success has been reported in associating positive reactions with the causative infection in so few instances as to have resulted in a certain amount of speculation regarding the significance of these reactions in male animals.

SCHROEDER and COTTON (Some Facts about Abortion Disease, *Journal of Agric. Research*, Vol. IX, No. 1, pp. 9-16, 1917) in investigating this problem describe two cases that came under their observation. They state that one of the bulls at the time of autopsy showed the presence of an abscess involving the epididymis of one testicle from which *Bact. abortus* was isolated. The other animal was permitted to serve a cow that was considered to be free from abortion disease. Seminal fluid which was recovered from the vagina immediately following the service and injected into numerous guinea pigs produced *Bact. abortus* lesions in one of the experimental animals.

REITGER and WHITE (Infectious Abortion in Cattle, *Connecticut Storrs Agricultural Experiment Station, Bulletin* 93, pp. 199-249, 1918) describe endeavours to associate the presence of the infection with positive serum reactions in three cases which they studied. In two of the animals neither abortus infections nor pathological changes could be demonstrated. In the third they call attention to the finding of two abscesses or cysts in the region of the groin near the point of attachment of the scrotum, but from these abscesses they were unable to isolate the abortion organism, thus failing to obtain bacteriological evidence of the infection.

In view of the positive bacteriological finding of SCHROEDER and COTTON the writers were prompted to undertake further investigations involving a considerable number of animals, in an endeavour to ascertain with what frequency abortus infection could be demonstrated in the generative organs of bulls giving positive or suspicious reactions to the agglutination test for this disease, and to determine whether or not pathological changes are commonly associated with such infections.

The procedure employed by the writers consisted in securing blood samples from the animals as they arrived at the abattoir and in applying to each sample the agglutination test. At the time of slaughter, which was usually the following day, those animals giving positive or suspicious reactions (37 of 325 mature bulls examined) were autopsied and the organs of the genital system were secured for further study.

(1) See also *R.* June, 1918, No. 656; *R.* Feb. 1919, No. 218 (*Id.*)

From the results the following conclusions are arrived at:—

Bact. abortus infection may involve organs of the generative apparatus of bulls, producing chronic inflammatory changes.

Of the generative organs, the seminal vesicles appear to furnish the most favorable site for the lodgment and propagation of abortion infection.

The presence of *Bact. abortus* infection in bulls appears to be more strongly indicated by relatively marked than by slight reactions to the agglutination test for this disease.

1170 - The Value of Active Immunisation against Cattle Plague, and the Connection between Cattle Plague and Malaria; Experiments Carried Out in Egypt. — PIOT BEV (President of the Egyptian Institute, Cairo), in *Annales de l'Institut Pasteur*, Vol. XXXIII, No 3, pp 197-207 Paris, March, 1919

The prophylactic measures formerly enforced by the Egyptian Government were interrupted by the special conditions obtaining since 1914. The consequences of this neglect were not long in showing themselves. Cattle plague made its appearance, in 1916, in several of the provinces of Upper Egypt, either owing to the disease breaking out again in centres of infection where it had not been stamped out thoroughly, or because, in spite of all the precautions taken, the importation of stock into the Sudan had spread the infection along their line of route. In 1917, cattle-plague had extended to almost all Lower Egypt. Therefore, the Egyptian Government recently resolved to resume the practice of active immunisation (the systematic and general application of the simultaneous method, namely, the use of serum and virulent blood). This method again proved its complete efficacy.

96 calves of two years of age that had been vaccinated, provided 98 % of the post-operation reactions. In 3 other lots, 2 consisting of 49 head, and 1 of 50, the proportions were respectively 79.83 and 76 %. In the 3 lots of three-year old calves, which consisted of 70.41 and 40 animals, the reaction percentage was respectively 70.68 and 77.

Hence, it is seen that susceptibility to cattle plague which is absolute in young calves, diminishes noticeably with age, and that 3 year-old calves are 13 % less susceptible than 2 year-old animals. The difference is still larger in the case of adult cattle from 4 to 7 years old; in fact, in 9 lots of adult cattle, each containing from 24 to 122 head, out of 459 animals there were 229 that gave post-operation reactions. From all these facts taken together, we may therefore conclude that cattle in Egypt become with age increasingly less susceptible to cattle-plague, but that natural immunity is, however, only enjoyed by about 50 % of these animals.

The writer has again found that the artificial immunity acquired by parents is apparently capable of being transmitted to the offspring (1), but the immunity of only one parent seems to have no effect upon the progeny.

(1) See R. April, 1919, No 483 (Ed)

In all countries where cattle plague is rife (Egypt, Sudan, Erythrea, Turkey, Russia, South Africa, India, the Philippines, etc.) it has been scientifically proved that there exists at the same time, one or more, haematozoic diseases in an endemic condition that would appear to furnish suitable grounds for the development of cattle plague. The hypothesis has even been put forward that, as in the case of distemper (*maladie des chiens*) and other affections, there is a kind of symbiosis existing between an invisible virulent element and an organism which is clearly seen under the microscope. The clinical and anatomical experiments made by the writer upon thousands of animals during over 20 years, however, cause him to reject any such theory.

It is true that the two affections may develop simultaneously in the same individual, but in a perfectly accidental manner.

The writer has inoculated calves attacked by cattle plague with fresh blood containing many parasites, and has also inoculated others with the same blood after it had been kept 24 hours in a refrigerator. None of these calves showed the least trace of Texas fever after 6 months, observation, in spite of the presence of *Piroplasma bigeminum* in the blood injected. We may, therefore, conclude that vaccination with plague-infected blood containing the hematozoa of bovine malaria is perfectly innocuous to calves and adult cattle in Egypt.

As to the length of the immunity conferred by the vaccination, the writer has found that it lasts experimentally for at least 3 years, and practically for over 5 years.

1171 - **The Piroplasma of Pre-Alpine Regions.** — COMINOTTI, L. and DI DOMIZIO, G., in *La Clinica Veterinaria*. Year XLII, No. 12, pp. 363-369. 1 pl. Milan, June 30, 1919.

European ovine piroplasma has been proved by Mr. STRACOVITCH (and subsequently, by a number of other investigators), to differ from the North American type which causes Texas fever.

The piroplasma of pre-Alpine regions is clearly distinct from *Piroplasma bigeminum* as regards its morphology. It is considerably smaller, the pyriform individuals occur united in pairs, there is a predominance of irregularly rounded, frequently granular forms, further the parasite tends to assume a marginal position, and occasionally, though rarely, the 4 component parts are disposed in the form of a cross. The writers' description of pre-Alpine piroplasma exactly coincides with KOSSEL and WEBER's description of the Finnish piroplasma which is morphologically the same as the European species.

In the course of their morphological investigations, the writers were able to ascertain the following facts: — The pulp of the spleen contains numerous red corpuscles infested by the parasites, which are almost exclusively of an irregular round or irregular annular shape. The micro-organisms are very rarely found in the circulating blood, whereas in the blood present in the section surface of the myocardium, there were many corpuscles acting as host to the piroplasma. The latter usually assumes the shape of a pear; the individuals generally occur in couples united to one another by an

acuminate portion, in such a manner as to make a very wide angle, sometimes of 180° . In these forms, the nuclear substance is not always easily distinguished from the protoplasm. In the circulating blood, the writer found a few granular forms (in addition to the irregularly annular ones), which had taken up their position in the periphery of the erythrocytes.

1172 - **Experiments Made in Austria to Determine the Toxic Action of Chemical Fertilisers Upon Sheep.** — GÜNTHER, G. and VON CZADLE, O. (Tierärztliche Hochschule und Landwirtschaftliche-chemische Versuchstation in Wien), in *Zeitschrift für das Landwirtschaftliche Versuchswesen in Deutschösterreich*, Year XXII, Parts 3 and 4, pp 69-82. Vienna, March and April, 1919.

A case of poisoning occurring in Carinthia in a flock of sheep grazing on a meadow recently manured, during wet weather, with basic slag kainit, and nitrate of soda, has again given rise to the question of the toxic effect exercised by chemical fertilisers upon flocks and herds.

This question is far from settled, and the information met with in the literature dealing with the subject is often contradictory. The Agricultural-Chemistry Experimental Station of the Ministry of Agriculture, in collaboration with the Veterinary College, undertook a series of experiments on sheep, using for the purpose the following chemical fertilisers. Basic slag, superphosphate, 15 and 40 % kainit, sulphate of ammonia, nitrate of potassium, nitrate of sodium, etc.

The sheep were given 100 gm. of these different compounds in their rations every day

As regards the basic slag, 2 out of 3 experiments had a fatal result. Therefore, the writers are of the opinion, notwithstanding certain previous statements to the contrary, that this fertiliser cannot be regarded as innocuous, although, practically; its effects may be less deadly than they proved to be in the experiment, owing to the fact that it is not spread so thickly as to make it possible for the animals to pick up such a large amount as was fed them. In the case of the superphosphate, death supervened in the first experiment (100 gm. of this fertiliser having been given daily) after 8 days, and in another experiment after 11 days. Care must therefore be exercised when land is manured with superphosphate.

Kainit, as results from half-a-dozen experiments, is poisonous if fed in the ratio of 3 to 4 gm. per kg. of live weight. It often produces intestinal inflammation and diarrhoea, which explain the apparently contradictory results of the experiments; for sometimes a relatively small amount has fatal results, while a much larger quantity gives rise to no serious disturbances. This is because, in the second case, most of the kainit is evacuated, owing to the diarrhoea, before it can be absorbed by the intestine.

Sulphate of ammonium, if taken in the proportion of about 4 gm. per hg. of live weight, causes death in a few hours; smaller amounts do not have a fatal result until several days have elapsed.

The fatal dose of sodium nitrate is, for sheep, from 1 to 2 gm. per kg. of live weight; but in this connection, we may repeat the remarks made above in the case of kainit.

As regards nitrate of potassium, the experiments, as well as all the

results reported in the literature dealing with the subject, show that this fertiliser is very poisonous, if taken by sheep in the ratio of 0.75 gm. to 1.50 gm. per kg. of live-weight, and nearly always causes death in less than 24 hours. Many factors, however, influence the toxicity of this compound, which depends firstly upon the constitution of the animal and secondly and chiefly, upon the condition of its digestive system, and its capacity of reabsorption.

This is proved by the fact, that a 1 % aqueous solution of nitrate of sodium, if swallowed, causes the death of the animal after 20 hours. Evidently, owing to the salt in solution being more easily and rapidly reabsorbed, the toxic action is more pronounced.

1173 - **Marra Immunising Serum For Sheep and Goats Attacked by Contagious Agalaxia.** — I BIANCHINI, B, in *Giornale di Medicina veterinaria*, Year XLVII, No 41, pp 617-622, and No 42, pp 665-671. Turin, October 12 and November 2, 1918 — II DE JU LITS, R in *La Nuova Agricoltura del Lazio*, Year VII, No 148, p 28 Rome, March 1, 1919.

For some years, the most serious disease attacking the sheep and goats of Iatium has been contagious agalaxia, (*asciuttarella*). This malady has also made its appearance from time to time in the Abruzzi, in Basilicata, in the Province of Caserta, in Capitanata, etc., where it assumed an infectious, wide-spread form giving rise to loss of milk and of lambs. It is declared to be incurable. It also occurs in an enzootic form in Switzerland, Germany and France, notably in the East Pyrenees. Contagious agalaxia spares cattle, but probably attacks wild ruminants.

As regards the etiology of the disease, the only points upon which investigators agree is that the virus is capable of filtration and is ultra-visible. The presence of the malady is shown by general symptoms (fever) and by local lesions (alterations of the udder, the eye-ball, and the articulations of the bones). Inflammation of the scrotum may occur in rams and male goats. An acute stage and a chronic one can be distinguished without any special causes intervening to produce them. When the disease attacks animals in milk, it shows itself on one half, or the whole, of the udder. Very little milk is produced, and it is much altered and useless; then the udder rapidly dries up, and remains in this condition for the rest of the animal's life. If the malady attacks mountain sheep in the summer, when they are pregnant, it gives rise to abortion causing great loss, as many as 20 % of the ewes may be affected in this way. Further, any animal suffering from this disease may be attacked by arthritis, lameness, blindness, endocarditis, etc.

The development of agalaxia in each animal takes from 25 to 35 days, but it continues for a very long time in the flock, for as soon as one sheep is well, another falls ill, and the disease thus can last for months, or even years,

The year following the outbreak, the "vecchiarelle" (two-year-old sheep) escape the disease at first, but contract it by lambing, which shows that the virus is latent, but nevertheless always active. It takes 4 years before the virus loses its force, so that, during this time, a flock that has

had the disease can infect any other sheep with which it may come into contact. According to Dr. MARRA's investigations, the virus gains in virulence when transmitted (it certainly does so when the disease is transmitted from a sheep to a goat). The contamination passes from the mother to the foetus, in the most various and unforeseen manners, infection being spread by pastures, the animals' sleeping quarters, the route followed by the travelling flocks, the shepherds, or goat-herds, and by the operation of milking etc. Animals that recover are immune for the rest of their lives: after having passed the acute stage, they fatten very well, and can be killed and eaten without any danger.

Dr. MARRA began his study of contagious agalaxia in 1891, and continued it until 1913, when he announced that he had discovered a way of rendering animals immune to the disease, and of treating them with a serum which has also an immunising effect.

Later, he carried out long public experimental tests under the control of commissions composed of veterinary surgeons and breeders, the writer himself always being present. These experiments were always completely successful, and Marra's Anti-agalaxic serum (a joint-stock company having been formed in Rome for its production and sale) has been put on the market as a recognised remedy.

Marra's Anti-agalaxic serum can equally well be used both for prophylactic and therapeutic purposes. In the first case, 10 cc. are inoculated into each animal of three months or over; in the second, 10 to 60 cc. are used according to the severity of the attack and the size of the patient. The hypodermic injection is made on the flat part of the thigh, in the usual manner.

The immunising serum can be used at all times, even during the period of advanced pregnancy, or of milk production. Lambs destined for breeding purposes should be inoculated systematically every spring.

D^e Raffaele DE JULIIS also reports good results obtained with Marra serum on many country farms in Latium.

1174 - **Effect of Heat on Trichinae** (1). — RANSON, B. H. (Chief of the Zoological Division) and SCHWARZ, B. (Junior Zoologist, Bureau of Animal Industry, U. S. Dept. Agric.), in *Journal of Agricultural Research*, Vol. XVIII, No. 5, pp. 201-220, Bibliography of 14 works. Washington, D. C., August 15, 1919.

It is a well-known fact that the larvae of *Trichinella spiralis* may be killed by thorough cooking and the meat thereby rendered safe for food so far as concerns the danger of trichinosis. As to the actual temperature required to kill the parasites, however, various writers give very different figures, so that the question of the thermal death point has been rather uncertain. Therefore it was found necessary to supplement the investigations on this question which are recorded in the literature with further experimental work. The paper under review sets forth the results obtained, from which the following conclusions are arrived at:—

The vitality of the larvae of *Trichinella spiralis* is quickly destroyed

(1) See also R., Nov., 1918, No. 1258 and R., June-September, 1919, No. 931. (Ed.)

by exposure of the parasites to a temperature of 55° C., gradually attained, the result apparently of irreversible coagulation changes in the protoplasm. This temperature may be considered the thermal death point.

Trichina larvae exposed to temperature slightly below 55° C. for short periods of time may recover from this exposure; but they die if exposed for longer periods, recovery or death depending apparently upon whether or not beginning coagulation of the protoplasm has proceeded beyond a stage from which a return to normal may occur. Exposed to temperatures in the neighbourhood of 50° C., *trichina* larvae die if the application of heat is sufficiently long continued, apparently as a result of exhaustion following excessive activity to which they are stimulated by the heat.

The longevity of *trichina* larvae freed from their cysts by artificial digestion and kept at temperatures ranging between limits at which they become quiescent from the effects of heat and cold, respectively varies inversely with the temperature.

Methods of destroying trichinae by heating at temperatures below the thermal death point, which may be utilised in connection with the preparation of certain kinds of cured pork products, appear not to be applicable in the case of fresh pork.

Upon the basis of the results of experiments recorded in this paper the Bureau of Animal Industry has selected a temperature of 137° F. (58.33° C.) as the minimum temperature to which pork and products containing pork are required to be heated when cooked in establishments operating under federal meat inspection. This temperature is several degrees above the thermal death point of *trichina* larvae, thus providing a certain margin of safety.

FEEDS AND FEEDING

1177. — **A Method for Expressing Numerically the Value of Proteins as Substances Inducing Growth.** OSBORNE, T B, MENDEL, L B and FERRY, R L, in *The Journal of Biological Chemistry*, Vol XXXVII, No 2, pp 227-229. Baltimore, Febr., 1919.

In a previous work (1) the authors state that the comparisons between the value of different proteins could be made only when the animals absorb the same quantity of foods in the same number of days and when they make during this period the same gains, as in this case the only variant is the protein factor. As, however, it is very difficult to obtain such conditions in practical experiments, they conceived of a method to express by numbers the value that proteins have for growth.

The quantity of foods absorbed, being strictly decided by the number of calories required by the animal, is approximately the same when, all other conditions being equal, foods having a high or a low percentage of protein are absorbed. When the proportion of protein contained in the food is so low that the protein factor alone determines the rate of growth, it should be possible to find the concentration which will induce the greatest gain in

(1) OSBORNE, T B and MENDEL, L B *Journal of Biological Chemistry*, Vol XXVI, No 1, 1916.

relation to the protein ingested when supplying foods which contain *different* percentages of protein. Given, however, the individual differences in growth capacity inherent to the organism, the gain made by two different animals on the same diet in the same time may show a falling off (as shown by a series of experimental data obtained by the authors) amounting to as much as 75 % *absolute value*. If, instead, the gain *per gramme* of protein consumed is considered, the difference is much less, though not negligible. In order, therefore, to lessen the errors caused by individual variation it is necessary to work with a much higher number of animals than has been used hitherto.

When the ration fed to white rats contained as proteins only 7.9 % of lactalbumin, the mean gain per gramme of protein consumed was 3 gm. When the ration contained as sole protein 12 % of casein, the mean gain per gramme of protein consumed was 2.25 gm. When casein was the protein used, there was, in comparison with lactalbumin, a *excess* in consumption of 24 % protein and 20 % foods in order to obtain the same gain in the same time. Economy in protein consumption may be made by reducing its concentration in the diet, but as the animal then grows more slowly, a greater consumption of foods is necessary to obtain the same gain. When growth is limited by the quantity of foods absorbed, protein may be used by the animal as a source of energy and therefore for growth there is a smaller quantity for promoting growth than is available when sufficient energy is supplied in other ways and when growth is determined only by protein. Hence, to determine the biological value of proteins, experimental methods based on the administration of a quantity of foods less than is considered sufficient to induce the maximum of growth must be discarded. On the other hand, the new method proposed by the authors, *viz*, the determination of the maximum gain per gramme of protein consumed, may be of great use in so far as it shows with a certain degree of exactitude the maximum efficiency of each protein, or mixture of proteins, for growth. Thus it is possible to determine and express numerically the efficiency of protein mixtures and compare it with that of either protein. The necessity for comparing proteins promoting growth not very different in quickness sets limits to this method, because the magnitude of experimental error increases with this difference.

Finally, the authors show in a table the gains obtained with diets containing the likely percentages of their sole protein (lactalbumin, casein and edestin, respectively) administered for comparison in limited or unlimited quantities. They conclude from these that the gain was almost always greater with unlimited rations. Hence, food economy is obtained by feeding young animals *ad lib.*, and economy in protein is obtained only by reducing the feeding value below that by which the normal rate of growth can be conserved.

Economy in feeding, during growth, depends on the right balance between proportion of protein and total energy supplied, and the optimum of protein is determined not only by the absolute quantity provided but also by its quality.

- 1176 - **A Study of the Part Played by Fats in the Utilisation and Assimilation of Albuminoids** (1). — MAIGNON, F., in *Comptes Rendus de l'Académie des Sciences*, Vol. 168, No. 12, pp. 626-629. Paris, March 24, 1919.

The writer has proved that fats act upon the albuminoids of a food ration, decreasing their toxic character and increasing their nutritive power. This last statement is based upon the following facts: — 1) in the presence of fat, the minimum necessary quantity of albumen is about 3 times less than when starch is used; 2) the albumen-starch ration which maintains a constant weight, contains a quarter more calories than the albumen-fat ration required for this purpose.

According to the author, these results are explained by the fact that fats take part in the synthetic reconstruction of the protein molecules. The probability of this hypothesis has been greatly strengthened by the work of MAILLARD on the role of glycerin in the formation of protein, when it acts as an agent bringing about the condensation of the amino-acids.

The author is of opinion that if it is necessary to use more albumen with carbohydrates than with fats, in order to meet the nitrogen requirements of metabolism, this is because fatty acids play a part in the utilisation of proteins. As soon as the fatty acids can be extracted from the albumen molecule, it is supposed that the fatty acids derived from the fats can coalesce with the amino-acid nucleus of a protein in course of formation, thus rendering possible the building up of an albumen molecule, which it would not have been possible to obtain with the available amino-acids without the help of the fats. The fatty acids would appear to assist in the alteration of the albumens that have been consumed, and in transforming them into specific albumens.

- 1177 - **Maintenance Ration; Sugars and Fats, Specifically Indispensable Foods; Minimum Requirement of these Foods.** — BERRY, H., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CI, XIX. No. 4, pp. 197-200. Paris, July 28, 1919.

Until recently, physiologists held that to assure a state of balance in the adult or growth in the young the minimum of nitrogen could be obtained from any kind of protein substance and that remaining food requirement could be met indifferently by fats or carbohydrates. This view has lately been modified in regard to nitrogenous foods (2), following on work which has shown the great importance of the molecular constitution of these bodies, but albumins are still held to play a special part in feeding, and the ternary foods are always considered as being substances not specifically indispensable.

Following on previous investigations (the author raised the question as far back as in 1912 after experiments described then) and current ones, the author regards carbohydrates and fats as specifically indispensable. Sugars and fats have plastic and functional rôles that have hitherto been attributed only to proteins.

(1) See also R. November, 1918, Nos. 1195 and 1196, and R. June, 1919, No. 752. (Ed.)

(2) See No 1176 of this Review. (Ed.)

1) **PLASTIC RÔLE.** — Carbohydrates enter in different quality and quantity into the constitution of nucleic acids (pentoses or hexoses), of cerebro-sides (galactose), of mucoids (glucosamine); and into the molecular constitution of the proteins in the plasma of various animals (glucose), etc. Thus, along with the purins, fatty acids (lignoceric, phrenosinic, etc.) and amino acids, the carbohydrates form part of characteristic prosthetic groupings in the animal, the tissue, and even the cell nucleus.

The fats, or at least certain of their constituents, in the most varied combinations (citric acid, alcohols and of fatty acids, saturated or unsaturated, hydroxyls, phosphatids, etc.) and in the most varied proportions, form part, like albumins and sugars, of the essential constituents of all cells.

This means that the necessary rôle of these substances could not be made evident in experiments where the ration is composed of natural foods.

2) **FUNCTIONAL RÔLE.** — The carbohydrates not only act as energy producers, as held up to the present time, but they have a real functional and more particularly chemical rôle. It has not been proved that the different sugars are interchangeable in the ration in an indefinite manner, because the power of isomerisation and of synthesis in the animal organism appears to be limited, at least in certain cases thus, levulose may be changed into glycogen by a diabetic patient when glucose cannot.

When it is considered that certain fats supply at one time energy, vitamines and sugar (glycerin from neutral fats, galactose from cerebro-sides, and α -glycerophosphoric acid from the phosphatids, etc.) it will be evident that the ration problem must be treated from a new point of view. It is necessary to arrange parallel diets with and without vitamines (factors A and B) and including on the other hand proteins, fats and sugars of well known molecular constitution.

In short, metabolic disturbance is eliminated only if the albumins, sugars and fats in the ration exist there in a fixed ratio. There is a minimum of sugar and of fat as well as of albumin, or rather there are minima of sugar and of fats (in the wider sense of the word) which vary with the molecular structure and the chemical function of the foods composing the ration.

1178 - **Contribution to the Physiology of Phosphorus and Calcium Metabolism as Related to Milk Secretion.** — MEGGS, E. B., BLATHERWICK, N. R., and CARY, C. A., in *The Journal of Biological Chemistry*, Vol XXXVII, No. 1, pp 1-75. Baltimore, January 1919.

For the development of our knowledge of the physiology of the milk secretion, it is desirable that we should discover in the blood the precursors of the various constituents of milk. The authors (who are members of the staff of the Bureau of Animal Industry, United States Department of Agriculture) have devoted much time to the subject, and considerable progress has already been made which promises to throw further light upon the problem.

When the precursors of milk are known, it will be necessary to find out how their concentration in the blood is maintained against the great

demand made upon them by the mammary glands of heavily milking animals.

The authors are of opinion that some help in the solution of this problem can be obtained from the study of the concentration of certain matters in the blood under various conditions, and have worked on this lines, paying special attention to phosphorus and calcium. They have, however extended their investigations also to other constituents of the blood whenever this appeared to be profitable.

The experiments consisted in analysing the blood and plasma obtained from the jugular, or from the abdominal subcutaneous, vein of intact or nearly normal cattle. The writers determined the ash of the blood and plasma, and the calcium, total phosphorus, lipid and inorganic phosphorus, total fat and nitrogen contained in the ash. They also studied the effect exerted upon the phosphorus in the blood by age, change of ration, gestation, and lactation. The results, which are are set forth in a series of tables, are summarised as follows:--

Normal blood plasma contains no phosphorised proteins and probably no phosphorus compounds at all, except phosphatids and inorganic phosphates. The phosphorus of these two classes certainly comprises more than 97 per cent. of all that exists in normal plasma.

In plasma, the precursor of milk fat and milk phosphorus is phosphatid (lecithin, or some related body).

The concentration of calcium in the plasma of cows is quite constant. Small variations can be induced by varying the amount supplied with the rations, but the chief controlling factor is probably the concentration of bicarbonate in the plasma. It is probable that the concentration of calcium tends to vary inversely with that of the bicarbonate.

The concentrations of phosphatid and of inorganic phosphorus in the plasma are highly variable. Both can be made to vary by changing the amount of phosphorus supplied with the rations, though the variations induced in this manner show themselves most markedly in the inorganic phosphorus. Both undergo variations as the accompaniment of increasing age and of the later stages of pregnancy. The phosphatid of the plasma shows a marked tendency to rise during the first month of lactation, and to remain high until lactation ceases. This phenomenon is largely independent of the diet, and is thought to be connected with the fact that, near the beginning of lactation, there is a tendency for the body fat to be released from its stores and thrown out into the blood.

1179 - **The Requirements for Growth in Cattle.** — GOUIN, A. and ANDOUARD, P., in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol V, No. 22, pp. 633-638. Paris, June 18, 1919.

Animals when they have made some growth consume only $\frac{2}{5}$ of the rations fixed by German rules so as to make a certain rate of progress. At an earlier stage the error is smaller, but still appreciable. WOLFF and KELLNER fixed the quantities of dry matter ingested per day at 2600 gm. per 100 kg. of live weight, for young animals which make indifferent growth. Now,

in the course of their experiments, the authors found only once, during a period of 10 days only, a subject capable of ingesting 2607 gm. of dry matter per 100 kg. of its weight on special rations. On the whole, animals of over 150 kg. which made a daily gain of 853 gm. consumed 2067 gm. of dry matter per day. The rules exceed the reality by 25 %, and lead to theoretical gains much below those obtaining in practice.

All foods do not behave in the same way during digestion. Some, of which the volume is considerable compared with their low feeding value, such as skim milk and roots, do not stay in the stomach long, because the organism soon gets rid of the water with which they are saturated.

Cakes and other concentrates take up little space in the digestive tract. The excreta they produce do not weigh more than the feeding principles they yield to the organism.

The opposite is the case with ligneous fodders. Hay remains a long time in the stomach. It attracts there an enormous quantity of water, the importance of which it appears impossible to appreciate, because a large part of such water is dispersed when the material being digested passes into the intestine. The weight of excreta produced by a very ordinary quality of hay is 6 times greater than the fraction of this feed utilised in digestion.

Only when we can add to the knowledge of food composition a knowledge of the way in which foods behave in the course of digestion, will it be possible to make up a food in which the proportion of bulky fodders will exactly meet the requirements for intensive rearing. If this proportion be too high, it will impede growth; if it is kept lower than necessary, there will be waste of concentrated foods and a serious loss to the breeder.

1180 - **Determination of the Distribution of Nitrogen in Certain Seeds.** — BREWSTER, G F., and ALSBERG, C L., (Bureau of Chemistry, U S Department of Agriculture, Washington), in *The Journal of Biological Chemistry*, Vol XXXVII, No 3, pp 367-371. Baltimore, March, 1919

Recent progress in the chemistry of protein nutrition has demonstrated that the latter is in reality amino-acid nutrition. Therefore an exact knowledge of the amino-acid content of foodstuffs is essential, and methods of protein analysis which furnish accurate results expeditiously are of the utmost importance. The Van Slyke method when applied to isolated and purified proteins partly meets this need, but it would be of still greater value if it could be applied to the direct analysis of seeds without previous isolation of the proteins. An investigation of this kind was made by the authors, and the results are shown in the annexed table.

The examination of the nitrogen distribution in certain seeds gives results which agree in general with those obtained by others who have used the same method. Where there is lack of agreement this might be due to the fact that different samples of seed of the same species may vary in composition.

In addition, the authors show that when yeast nucleic acid is subjected to the van Slyke procedure, 15 % of the total nitrogen of the acid

*Distribution of nitrogen in certain seeds and in yeast nucleic acid
as determined by the VAN SLYKE method.*

	Total N as % of substance examined	Nitrogen in per cent. of total nitrogen								
		Amide N	Humic N in line	Humic N precipitated with bases	Arginine N	Histidine N	Cystine N	Lysine N	Amino N in filtrate from bases	Non-amino N in filtrate from bases
Cottonseed flour	7.9025	10.97	10.97	—	19.73	3.83	1.11	0.69	43.50	5.27
Tomato seed (pressed) . . .	6.5550	10.38	12.03	—	16.32	—	1.27	8.39	45.86	5.09
Cow pea	4.0962	0.88	5.34	2.87	17.68	3.64	1.23	5.98	49.12	4.08
Jack bean	3.3074	7.56	6.35	4.11	9.83	6.08	0.79	9.90	45.54	9.10
Maize	1.8499	13.94	9.35	—	7.75	2.40	1.60	2.06	57.86	6.28
Maize germ (pressed) . . .	3.3100	12.69	14.71	—	11.04	5.84	—	5.62	45.07	6.92
Wheat	2.7749	18.65	6.26	1.25	8.96	1.73	7.87	2.65	48.79	13.37
Kafir corn	2.3399	16.34	4.85	—	7.17	1.32	1.02	1.68	59.01	7.69
Kafirin	16.4813	20.74	0.04	0.07	3.08	1.64	0.55	1.04	65.20	7.29
Nucleic acid of yeast * . .	15.7242	24.00	10.87	22.09	15.03	—	—	—	—	—

* The percentages of the different forms of nitrogen are uncorrected.

appears in the arginine fraction, although the nucleic acid contains no arginine. This indicates that in the determination of the distribution of the nitrogen in materials containing nucleic acid by the method of van Slyke, erroneous results may be obtained because some of the purine and pyrimidine nitrogen appears in the arginine fraction.

1181 — **Certain Desert Plants as Emergency Stock Feed.** — WOOTON, E. O., in U. S. Dept. of Agric. Bulletin, No. 728, 27 pp. 1 fig. 8 pl. Washington, December 18, 1918.

The author discusses some plants which grow in desert regions near the Mexican frontier and which have been or could be used as emergency feeds. These plants are: — *Yucca elata*, (soap weed), *Y. glauca*, *Y. baccata*, *Y. macrocarpa*, *Y. brevifolia*, *Y. rupicola*; *Agave Lecheguilla*; *Dasyllirion Wheeleri*, *D. texanum*; *Nolina erumpens*, *N. microcarpa*; *Samuela Faxoniana*; *Clitoyucca arborescens*; *Hesperoyucca Whipplei*; *Hesperaloe parviflora*.

The author gives an analysis of the 12 first species: — their content in mineral matter varies, according to species, from 2.9 (*Nolina microcarpa*) to 8.9 % (*Agave Lecheguilla*); crude protein from 3.7 (*Nolina microcarpa*) to 8.6 % (*N. erumpens*); ether extract from 1.5 (*N. microcarpa*) to 2.8 % (*N. erumpens*); fibre from 28.4 (*Yucca elata*) to 46.6 % (*N. microcarpa*); nitrogen-free extract from 41.2 (*N. erumpens*) to 55.4 % (*Yucca elata*). All these percentages are on the water-free basis. On the whole, the chemical analyses of these plants shows, and are borne out in practice by stockmen, that they are of low nutritive value, just sufficient to keep

animals fed on them alone from starving, but when they are supplemented by concentrates they make a good ration. Users of desert plants ordinarily give, per head daily, 6 to 12 lb. of soap weed + $\frac{1}{2}$ to $\frac{3}{4}$ lb. of cottonseed cake or meal to young stock, and 20 to 40 lb. of soap weed + 1 to 2 lb. cottonseed cake to mature stock. Of the chopped feed alone, 20 to 25 lb. per day will save stock from dying. With a pound of cottonseed cake in addition, a fairly well-balanced maintenance ration is produced. The average cost of feeding about 20 lb. of chopped soap weed per animal per day is about 50 cents a month.

Only two of the species of the plants discussed may be expected to renew themselves if cut off: *Yucca glauca* (bear grass) and *Y. elata* (soap weed), the former in 3 or 4 years, the latter in 10 or 15. Hence these plants should be used only for emergency conditions and allowed to grow during favourable seasons.

The essential factor for the use of desert plants as feed is the construction of a satisfactory chopping machine, because hand chopping is slow and is otherwise unsuitable. There are at present on the market 4 good chopping machines, consisting essentially of a heavy cylinder revolving on a horizontal shaft and carrying knives or cutting teeth which pass close to a chopping block on to which the plants are brought by a feeder or by gravity.

1182—The Results of the General Live Stock Census taken in Italy on April 6 and 7, 1918. — MASCHERONI, E., in *L'Industria lattiera e zootecnica*, Year XVII, No. 17-18, pp. 163-164. Reggio Emilia, Sept. 1-15, 1919.

The last two live stock censuses in Italy gave the following results: —

	Census of 1908	Census of 1918
Horses	955 051	989 786
Asses	848 988	949 162
Mules and hinnies	388 361	496 743
Cattle	6 190 990	6 239 751
Buffaloes	19 362	24 026
Pigs	2 503 733	2 338 926
Sheep	11 060 420	11 753 910
Goats	704 503	3 082 558

The totals for 1918 include: 185 266 horses, 4550 asses, 187 868 mules and hinnies, 77 482 oxen, 12 buffaloes, 1620 pigs and 2334 sheep belonging to the military authorities — 1062 horses, 14 asses and 4 goats belonging to stallion centres — 855 horses, 1 ass, 197 mules and hinnies, 6585 cattle, 2 pigs and 1 sheep in transit by railway. On deducting these numbers from the general totals, the following figures are obtained, showing more precisely the real conditions of stock breeding: — horses 802 603 — asses 944 597 — mules and hinnies 308 678 — cattle 6 155 674 — buffaloes 24 014 — pigs 2 337 304 — sheep 11 751 575 — goats 3 082 554. The richest in horses of the 16 Italian regions is Lombardy (145 794); for asses

the most important parts are Sicily (205 099) and Campania (133 039); for mules and hinnies, Sicily (127 799); for cattle, Lombardy (1 215 695), Emilia (1 082 089) and Piemont (1 088 143); for buffaloes, Campania (17 390); for pigs, Emilia (335 167), Lombardy (331 266) and Campania (223 234); for sheep Sardinia (2 018 612), Apulia (1 360 886), Latium (1 277 541) and Tuscany (1 225 155), for goats, Sardinia (633 058), Sicily (476 539) and Calabria (441 852).

1183 — **Cooperative Bull Association in the United States.** — WINKLER, J. G., in *Farmer's Bulletin* 993, U. S. Department of Agriculture, 35 pp. 7 figs. Washington, July, 1918.

Cooperative Bull Associations are formed by farmers for the joint ownership, use and exchange of pure-bred bulls. The purchase price and cost of maintenance are distributed according to the number of cows owned by each member. In addition, the association helps its members in the sale of stock and dairy products, in combating contagious diseases, and in the improvement of the dairy industry. An outlay of 50 dollars per annum gives the right to the use of 5 bulls.

The author briefly reviews the history of these associations in the United States, showing up their advantages, which comprise the keeping of a smaller number of high class bulls, the low cost of cooperation, the quick repayment of capital invested, the possibility of line breeding, the elimination of low grade animals, etc. He emphasises the influence of heredity and of the bull as factors in improving the herd, deals with the educational value of these associations, indicates the steps to take in eradicating infectious diseases, and finally offers suggestions as to constitution and by-laws for the foundation of bull associations.

1184 — **Crossing and Selection of Horses raised in the Wild State.** — CENCELLI, in *Rivista di Biologia*, Vol. I, No. 1, pp. 91-92. Rome, Jan-Feb. 1919.

In the horses of the Maremma reared in the wild state, the cutaneous muscles are very much developed; they contract strongly, producing a vigorous twitch, the skin over the hams, shoulder and back when stimulated, especially when insects with a painful bite land on the skin. The cutaneous muscle is therefore a protection to the organism of the horse, as breeds having this muscle well developed can easily defend themselves against insects, especially *Gastrophilus equi*. This explains why horses of the Maremma which, during the summer and autumn months, are always attacked by these gad flies and have the fore part of their bodies covered with the characteristic eggs of this insect, experience no ill effects from them.

In a Maremma horse-breeding station at Tolfa the author used an Anglo-Irish stallion foaled in Latium. He got colts which were fine and robust the first few months, but which after weaning lost condition rapidly and died the first or second year. Autopsy showed they were infested by thousands of bots. Hence, crossing with the Anglo-Irish stallion had favoured attack by the *Gastrophilus*: in fact, the skin muscles in the progeny were little developed, which verifies the above-mentioned observations of the author. The conclusion is that in the wild or half-wild system of rear-

ing the breed should not be refined, and selection rather than cross-breeding should be the means used for improvement.

1185 - **The Colour of the Newly-born in Italian and French Breeds of Cattle.** — CENSI MANCIA, G. B., in *L'industria lattiera e zootecnica*, Year XVII, No. 16, pp 151-152 Reggio Emilia, August 17, 1919.

CATTLE

The author sets out the results he arrived at in the different provinces of Italy in an inquiry on the colour of the skin at birth of all the Italian breeds of cattle. The results are summarised in the appended table (p. 1180). For naming the stock he used SANSON'S classification as not being in conflict, regarding Italian breeds of cattle, with his own study.

After a series of considerations on the data he collected, the author concludes that : — (1) the changes in colour of certain breeds of cattle as they age are worthy of the greatest attention ; (2) spotted skin keeps in the adult stage the shade and marking it had at birth and it may be concluded by analogy that cutaneous markings are wholly clear during intra-uterine existence (if the Cotentine breed was no exception) ; (3) change of colour with age is notable only in breeds of supposed Asiatic and Alpine origin (are these breeds not yet fixed? are they of more recent origin?) , (4) it is more difficult to interpret what is observed in mixed breeds, but the colour at birth, though not of a constant character, may enlighten us as to their first origin.

From the author's investigations in France on the same subject, in which Prof. PAUL DECHAMBRE was good enough to take part, it appears that the colour at birth differs from that in the adult stage only in the case of the following breeds —

COTENTIN (*Bos taurus germanicus*) at birth the skin is not blotched, which recalls the colour of some Danish or Mastiff dogs in which blotches appear 6 or 7 weeks afterwards.

VENDÉE-ENNE-PARTHENAISE (*B. t. ligeriensis*) the colour of the young is darker than that of the adults.

Calves are born of grey-brown or dark tawny colour. The same fact is observed in all other breeds of tawny colour or with black extremities.

TARENNAISE (*B. t. alpinus*) the calf is badger grey and the adult tawny coloured.

GASCON (*B. t. alpinus*) the calf is darker in colour than the adult.

BAZADAISE (cross-breeds) the calves are born with an intense blond colour and take the characteristic grey-chestnut colour with light extremities after the first few months of existence.

AURE or Central Pyrenees (*B. t. alpinus*) : at birth the calves are tawny with an ash-grey colour which later turns to chestnut round the muzzle and eyes.

1186 - **Weights of Typical Shorthorns in the United States.** — TOMNEY, J. L. (American Shorthorn Breeders' Association), in *The Breeders' Gazette*, Vol. LXXV, No. 24, pp 1408-1410, Chicago, June 12, 1919

The weights of all Shorthorn breeding animals shown at the International Live Stock Expositions of 1908 and 1910 were taken as matters

Origins	Breed	Colour at birth	Colour of adult
Asiatic (<i>B. t. asiaticus</i>)	Riese		
	Romagnolo		
	Garfagnina		
	Maremmata (of the Maremma)		
	Aquilana (of Aquila)		
Asiatic (<i>B. t. asiaticus</i>)	Fugliese (of Apulia)		
	Campana (of Campania)		
	Basilica (of Basilicata)		
	Calabrese (of Calabria)		
	Montanare		
Iberian (<i>B. t. ibericus</i>)	Chianina (of Val di Chiana)		
	Marchigiana (of the Marches)		
	Of middle Tiber valley		
	Of Abruzzi littoral		
	Reggiana (of Reggio Emilia)		
Iberian (<i>B. t. ibericus</i>)	Parmigiana (of Parma)		
	Placentina (of Piacenza)		
	Modenese (of Modena)		
	Pontremolese (of Pontremoli)		
	Sacellina		
Alpine (<i>B. t. alpinus</i>)	Piedmontese		
	Brown Alpine		
	Bellunese (of Belluno)		
	Cadorina (of Cadore)		
	Friulana (Siumenthali)		
Jurassic (<i>B. t. jurassicus</i>)	Canic		
	Swiss		
	Of Val d'Aosta		
	Tarinea		
	Buriana		
Cross breeds	Five black cows		
	Sarda (Sardinian)		

of record in preparing the following table, indicating the average weights of Shorthorns at various ages when well grown out for show.

Weights of Shorthorns at 1908 and 1910 Internationals.

Ages	Number shown		Range in ages		Range in weights		Average weights		
	1908	1910	1908	1910	1908	1910	1908	1910	Average of both years
			days	days	Lb.	Lb.	Lb.	Lb.	Lb.
Bulls:									
Three years or over	10	17	1360-2246	1140-2151	1970-2510	2030-2620	2334	2280	2302
Two years	14	13	820-1184	885-1143	1755-2180	1710-2169	1954	1982	1967
Senior yearling	3	5	731-771	708-821	1755-1845	1450-1710	1785	1574	1653
Junior yearling	10	12	456-674	553-692	1290-1655	1300-1720	1496	1493	1495
Senior calf	20	21	350-440	330-454	915-1310	960-1350	1106	1135	1121
Junior calf	21	16	131-329	225-330	420-1130	700-1115	815	859	834
Females									
Three year or over	7	10	1424-2411	1209-2555	1415-2005	1590-2210	1817	1876	1851
Two years	15	14	881-1176	909-1166	1410-1825	1440-1770	1572	1591	1580
Senior yearling	15	17	700-819	698-814	1110-1405	1070-1540	1309	1364	1338
Junior yearling	21	14	513-691	448-695	995-1485	880-1360	1212	1192	1205
Senior calf	30	31	332-455	336-454	785-1140	780-1120	925	959	942
Junior calf	24	19	166-327	216-329	390-885	64-930	730	785	755

The weights of the first-prize animals throughout the various classes are as follows: -- Whitehall King 2465 pounds and White Star 2240 lb. in the aged bull classes; Gloster Knight 1910 and Ringmaster 1970, in the two-year-old class; Ruberta's Goods 1755 and Roan Sultan 1710 in the senior yearling classes; King Cumberland 1590 and True Cumberland 1720 as junior yearlings; and Premier Knight 830 and Dale's Renown 800 as junior calves. In the female classes, Flora 90th and Princess Marshall, cows over three years, weighed 1960 and 1830 lb. respectively; Sweet Duchess of Gloster and Susan Cumberland 1650 and 1530 respectively as two-year-olds; the senior yearling heifers Elmendorf Lassie and Mandolin 3rd 1403 and 1520; Snowbird and New Year's Delight 1375 and 1300 respectively, as junior yearlings; Diamond Anoka and Mary Ann of Oakland 1135 and 1040 as senior calves, and as junior calves Susan Cumberland and Mildred Snow weighed 730 and 920 lb. respectively.

1187 - Milk as the Sole Diet of Ruminants. — McCANDLISH, A. C., in *Iowa Agricultural Experiment Station, Research Bulletin* 48, pp 3-11. Ames, Iowa, 1918.

Two bull calves, one a grade Jersey castrated at the age of 22 days and the other a grade Holstein not castrated, were fed on nothing but milk and common salt from the date of their birth until their death, which occurred at the age of about 30 and 25 weeks, respectively. The digestible protein and total digestible nutrients consumed were in excess of those called for by the modified Wolff-Lehmann standard.

A series of tables shows: — body weight, height at withers, depth of chest and width at hips, determined every 30 days; and amount of feed consumed in successive 10-day intervals. For comparison, the average of weights and measurements of 66 normally fed heifers are presented also.

At the end of 6 months the Jersey calf had increased his body weight 111 per cent. At the end of 5 months the Holstein had increased his 91 per cent., while the heifers in 6 months averaged a 345 per cent. increase. During the same periods the percentage increase in height was 14 for the Jersey, 27 for the Holstein and 35 for the heifer calves. Increase in depth was 19, 11 and 57 per cent. respectively. Neither of the experimental animals thrived after reaching the age of 3 months. They suffered from fits and large patches of skin became devoid of hair.

Autopsies were made of both calves. The bones of the Jersey steer were very flexible as if insufficient ash were present; the leg bones could be bent comparatively easily while the ribs had a very thin coating of hard material with a soft core. None of the bones was as rigid as would be expected in an animal of similar age. There was one atrophied kidney (perhaps congenital) with hypertrophy of the other. The mesenteric lymph glands were much enlarged and there was apparent leukemia. The rumen was of normal size, but the walls were evidently atonic, due apparently to a development of lymphoid tissue. The omasum was smaller than would be expected, though the two remaining compartments of the stomach appeared to be normal. The contents of the rumen resembled thin cottage cheese mixed with hair. In the case of the 6-months Holstein bull, the bone appeared to be in fairly good condition, though one or two of the ribs might previously have been broken and healed. The mesenteric lymph glands were enlarged and both kidneys were in bad condition with cysts. All the stomach compartments were of about normal size, but there were streaks of dark brown or black pigment on the inner wall of the abomasum. The contents of the rumen were similar to those of the Jersey calf.

1188 - **Some Factors influencing the Rate of Growth and the Size of Dairy Heifers at Maturity.** — ECKLES, C. H., and SWETT, W. W., in *Missouri Station Research Bulletin* No. 31, pp 3-56, 1 pl., 15 figs. Columbia, Missouri, 1918.

To serve as standards of growth for Holsteins and Jerseys, data are published of the body weight and height at withers by months of a group of heifers of each breed that were kept under normal conditions, that is, fed on skim milk from 2 weeks to 6 months of age, with alfalfa, silage and a small amount of grain in winter, and good blue grass pasture in summer. The plan was to keep the animals in a good thrifty condition but not fat. The use of height at withers to measure skeletal growth is justified by computations showing that the percentage increments in height at hips, heart girth, and distance from shoulder-point to pin-bone in successive ages maintain an approximately uniform ratio to the corresponding increments in height at withers. As was expected, the ratios for hip width increased with age.

The weights at birth and the mature heights of 30 Holstein and 32 Jer-

sey heifers are tabulated individually, the heights at intermediate ages being also given for some of the animals. Little or no influence of birth weight on adult height was discovered.

Note is made of a Jersey heifer which at the age of 6 months was put on a diet as low in calcium and phosphorus as could be secured from feeding stuffs likely to be used in practice. The growth in weight and height was normal for 13 months thereafter, when a physical breakdown ensued.

The rest of the bulletin — the major part — is devoted to the presentation of the complete results of a study, previously reported (1), of the influence of quantity of feed on the changes in weight and height of dairy heifers from birth to maturity and the effect of early calving on their subsequent body development. Evidence is produced showing that the check in growth of young animals after parturition is a result of the physiological drain, not of pregnancy, but of lactation.

1189 - **Influence of Breed and Size on Milk Production and Composition.** — See No. 1229 of this *Review*.

1190 - **The Feeding of Concentrated Food to Dairy Cows on Pasture in England.** — *The Journal of the Board of Agriculture*. Vol. XXV, No. 1, p. 11-17. London, April, 1918 (2).

This article reviews five trial tests carried out during recent years at several Institutes (Armstrong College — Southeastern Agricultural College — Leeds University — West of Scotland Agricultural College) in order to allay any undue apprehension as to the decrease in milk production as a result of the rule laid down by the Board of Agriculture and the Ministry of Food during the War, namely, that cows in milk while on pasture should receive no concentrated food before the beginning of August.

It rarely happens in agricultural experimental work that the results obtained in different experiments carried out in such widely scattered centres, are so uniformly concordant as in the experiments dealt with in this article. They all agree that, so far as milk production is concerned, the feeding of concentrated food to milch cows on pasture is only required in the latter half of the pasturage season, that is to say, from mid July onwards. In the earlier half of the season, cows receiving concentrated food did not give more milk than those that received none. Neither the quantity nor quality were bettered, nor were the cows in improved bodily condition.

Even during the following months, when the effect of "cake feeding" began to show itself, the results were so modest that there could be no question of much profit. The only possibility of profit lies in an improved manuring of the pasture, but the benefit would be dearly brought.

1191 - **The Influence of Barley on the Milk Secretion of Cows.** — WOLL, F. W. and VOORHIES, E. C., in the *Agricultural Experiment Station, Berkeley, California, Bulletin* No. 305, pp. 352-434. Berkeley, Cal., 1919.

The authors have furnished complete details of amounts and kind of feeds consumed, the body weights, and the quantity of milk and butter

(1) See *R.*, Oct. 1916, No. 1094. (Ed.)

fat produced by : -- (1) a grade Holstein cow during three lactations in which the only grain fed was barley, and during two in which mixed grains were fed ; (2) a pure bred Jersey, during four lactations, in one of which barley was the sole grain fed ; (3) another pure bred Jersey during two lactations in one of which a mixed grain was given, while barley was fed in the other. The authors also compare the production records of 15 other cows, most of them used previously in similar studies (1) during short periods (generally 5 weeks) of barley feeding, with their production records during the intervening period when they received mixed grain feeding.

An increased milk flow generally accompanied barley feeding, but the authors do not attribute this to the barley itself, but to the accident that when the cows only received barley feeding, they often consumed a larger quantity in comparison with mixed feeding. The authors do not call their trial tests, critical experiments, but the tests show that barley feeding has no deleterious effect on milk secretion, as is contended by some breeders of milch cows.

1192 - **A Comparison of Concentrates for Fattening Steers in the South of the United States.** — WARD, W F., JERDAN, S S and LLOYD, E R, in *United States Dept of Agr Bulletin* 761, 16 pp., 1919 (from Abstract in *Experiment Station Record*, Vol 40, No 9, pp 873-874 Washington, 1919)

These results of 2 years' steer feeding are part of a series of experiments conducted by the U. S. Department of Agriculture and the Mississippi Agricultural Station.

Three lots of 25 steers were fed each winter for the purpose of studying the value of cottonseed products when fed as sole concentrates or combined with some form of maize grain. The roughages the first year were maize silage and cowpea hay ; in the second year maize silage and oat straw with Johnson grass substituted for the latter toward the end of the period. The lots receiving maize were accompanied by pigs. The principal data for each of the 2 years of the trials are summed up in the annexed table, in which the cost of the feeds was estimated as follows : — cold-pressed cottonseed cake \$16.50, cottonseed meal \$22.50 the first year and \$27 the second, per ton ; maize 70 cents per bushel ; silage \$3, cowpea hay \$10 and oat straw \$5 per ton.

Three lb. of cottonseed meal proved to be equal in feeding value to 4 lb. of cold-pressed cottonseed cake. The meal contained 40.4 % protein and the cake 27.6 %. The latter was much relished.

In the first year cottonseed meal and maize and-cob meal, in the proportion 2 : 1, did not prove economical. In the second year, however, it was concluded that if the lots receiving cottonseed meal and ear maize (1 : 2) and cottonseed meal and shelled maize (1 : 2) respectively are each credited with \$3 worth of pork, they paid for the maize and then made about as much profit as the lot receiving cottonseed meal alone.

In both years all lots were well finished and very uniform.

(1) See R., March, 1916, No 323. (Ed.)

Comparison of concentrates for fattening steers.

Concentrates	Duration of test	Initial weight per head	Average daily gain per head	Feed consumed per pound of gain				Feed cost per pound
				Cottonseed product	Maize grain	Maize silage	Hay or straw	
	Days.	Lb	Lb	Lb			Lb	Cents
Cottonseed meal . . .	123	863	2.04	3.25	—	19.7	0.71	7.0
Cold-pressed cake . .	123	860	2.01	5.02	—	15.4	0.73	6.8
Cottonseed meal + maize and cob meal . . .	123	805	2.05	2.49	1.25	19.3	0.75	7.8
Cottonseed meal . . .	141	824	1.56	3.66	—	25.0	3.10	9.5
Cottonseed meal + ear maize . . .	141	824	1.66	1.81	4.57	22.4	1.73	10.8
Cottonseed meal + shelled maize . . .	141	826	1.70	1.77	3.55	22.6	2.05	10.7

1193 - **Mineral Requirements of Sheep.**—FRAPS, C. S., in *Texas Agricultural Experiment Station, Bulletin* 232, pp. 5-20, 1 fig., Austin, Texas, 1915

For each component of the ash of rations fed to sheep in 48 digestion experiments this bulletin furnishes data as to the amount fed per day, the amount not recovered in the faeces, and for 10 of the experiments the amount found in the urine.

Eighteen of the digestion trials were made in triplicate and 29 in duplicate, while 1 ration was fed to a single animal only. The digestibility of the organic nutrients and total ash of the rations of 43 of the experiments have been given in three previous bulletins (*Texas Sta. Bull.*, No. 147, pp. 5-28, No. 166, 1914, and No. 203, 1916), while the details of 5 are unpublished. In most of the experiments the ration consisted of single roughage; in the others, of alfalfa plus a supplement. The roughages fed were accuff sorgo fodder, alfalfa hay, Bermuda hay, bur clover hay, buffalo grass hay, maize fodder, cowpea hay, Guam grass hay, Johnson grass hay, Kafir corn fodder, millet, oat hay, peanut hay, para grass hay, prairie hay, Rhodes grass hay, rice hay, rice straw, sorghum and cowpea silage, sorghum hay, Jabosa grass, hay, and vetch hay. The supplements to alfalfa were maize bran, cold-pressed cottonseed cake, cottonseed meal, a mixture of cottonseed meal and hulls, Kafir corn chop, Kafir corn head chop, groundnut hulls, rice bran, rice hulls and rice polish. A table gives the percentages of silica (insoluble ash), lime, magnesia, phosphoric acid, and

potash found in the samples used of all these feeding stuffs except Guam grass hay.

The author points out that the rectum is a recognised path of excretion from the body of some mineral elements, but finds it convenient to speak of difference between the intake and the faecal content as the amount digested and also to call the percentage of the intake that is "digested" the coefficient of digestibility. A table shows the digestibility of several constituents of the ash for each of the rations, except Guam grass, or 44 in all. In 14 of the silica entries, 10 of the lime and 12 of the phosphoric acid the digestibility was zero, that is the amount in the faeces exceeded the amount fed. There were no cases of "negative digestion" of magnesia and potash. The averages of such of the 44 determinations of the coefficient of digestibility as were not zero are given by the author as: silica 22.2, lime 32.3, magnesia 32.3, phosphoric acid 22.5, and potash 83.2. Grouping the determinations by the amounts ingested shows, in the case of lime and phosphoric acid at least, that the coefficient of digestibility increases with an increase in the amount consumed, negative digestion figures occurring only as a rule when this amount was small. This condition indicates that fairly constant amounts of each are eliminated daily in the solid excrement. For lime the daily elimination is held to be about 0.6 gm. and the corrected digestibility to be about 25 %. For phosphoric acid the elimination is 0.8 gm. and the approximate true digestibility is 50 %. The data also indicate that an increased digestion of 1 gm. of lime is accompanied by an increased retention of 0.74 gm. of phosphoric acid. This ratio suggests to the author the formation of tricalcium phosphate.

Analyses of the urine collected in the balance experiments show that the mineral constituents appear in the urine in fairly constant amounts which are little if at all influenced by the amounts eaten or the amounts digested. It appears that 1.7 gm. of phosphoric acid, 2.8 gm. of lime, and 1 gm. of magnesia are required per day by sheep weighing about 100 lb. in order to maintain a mineral balance. About 0.2 gm. of potash and 0.54 gm. of magnesia per day were stored by these sheep.

In 18 experiments data are furnished as to the sulphur trioxide content of feed and faeces. The coefficients of digestibility averaged 47.9 %. Since most of the sulphur was probably in combination with the protein of the rations, the coefficients of digestibility of the latter are given for comparison. Their average is stated as 48.4.

1194 - Maize Supplements and Substitutes for Fattening Lambs. — DUNN, R. and EDWARD, J. M., in *Iowa Agricultural Experiment Station Bulletin* 185, pp. 3-14. Ames, Iowa, 1919

From a group of 172 range lambs, 5 lots of 30 each were selected and fed for 82 days, beginning November 16, 1917, for the purpose: (1) of testing linseed meal, velvet bean feed meal and peanut meal as protein supplements to a basal ration of shelled maize, maize silage and alfalfa hay, and (2) of determining the value of maize gluten feed as a partial substitute for maize in such a basal ration without supplement

The main results from the control lot and the three lots fed supplements are given in the subjoined table. The supplements were fed scattered over the silage in amounts so adjusted that each of the latter lots received equal amounts of protein from this source. The other feeds were given according to appetite.

Comparative value of protein supplements in fattening lambs.

Supplement	Initial weight per head	Average daily gain per head	Food consumed per pound of gain			Feed saved by pound of supplement			
			Supplement	Shelled maize	Maize silage	Alfalfa hay	Shelled maize	Maize silage	Alfalfa hay
	Lb	Lb	Lb	Lb	Lb	Lb	Lb	Lb	Lb
None	65.7	0.26	—	3.80	9.50	2.11	—	—	—
Linseed meal	65.4	0.29	0.53	3.31	8.36	1.86	0.94	2.15	0.48
Velvet bean meal	65.8	0.28	1.03	3.38	8.38	1.75	0.41	1.09	0.35
Peanut meal	65.9	0.28	0.50	3.38	8.24	1.85	0.6	2.54	0.53

The feeding of supplements, although increasing the grain required per pound of gain, enhanced the selling value of the lambs from 5 to 20 cents per 100 lbs. and made a more favourable margin per lamb. Taking into account all the factors, it is computed that \$118.00 per ton could have been paid for the linseed meal, \$67.20 for the velvet bean feed meal and \$143 for the peanut meal without reducing the margin per lamb below that of the control lot. The actual purchase prices were \$60, \$45 and \$55 per ton respectively.

The fifth lot received maize gluten feed exclusively instead of shelled maize during the first 60 days, and a mixture of maize gluten feed, shelled maize and linseed meal (6:1:1) during the final 3 weeks. The average daily gain per head was 0.26 lb. It is estimated that the maize gluten feed was 97.7% as efficient as shelled maize when fed with silage and alfalfa. There was a small saving of maize silage and hay, but the total grain required for a pound of gain was considerably increased.

The dressing percentages varied from 52.9 for lot 5 to 54.2 for the lot receiving peanut meal. The carcasses of the velvet meal lot graded first in colour, covering of fat and firmness, with the peanut meal lot a close second. The control and gluten feed lots graded last in these respects.

Block salt was given freely to each lot.

1195. Quantity and Composition of Ewes' Milk: Its Relation to the Growth of Lambs.

— NEIDIG, R. E., and IDDINGS, E. J., in *Journal of Agricultural Research*, Vol. XVII, No. 1, pp. 19-32. Washington, April 15, 1919.

During the progress of an investigation upon different breeds of sheep at the Idaho Agricultural Experiment Station, observations were made upon

the rate of growth of lambs from five breeds of ewes that are commonly found in that section of the country. The results indicated that lambs from some of the breeds made a decided gain over others in the same period of time. It was therefore considered opportune to undertake a special inquiry on the subject.

The chief factors in growth are inherited capacity and a sufficient quantity of nutritious food. In this article the authors study only the second factor.

As early as 1850, data were collected giving the analysis of ewes' milk. They show the great variation that occurs between different breeds and within the breeds in yield and fat content. FULLER and KLEINHEINZ of the Wisconsin Station weighed a lamb before and after sucking the mother ewe. They observed that, when the ewes were milked by hand, only about half the quantity of milk was obtained as when the milk was sucked by the lamb.

The authors used three ewes from each of 6 breeds in the experiment, after selecting those that showed the nearest to the normal milk yield for their breed. The period of investigation lasted 50 days. Every 10 days after lambing the total quantity of milk was recorded, and samples of milk were taken. The weight of the lamb was taken at birth and every 10 days thereafter. The data thus obtained are shown and discussed by a series of tables. The following are some of the most important facts resulting. —

With all the ewes there was a decrease in the milk flow at the end of the 50 day period as compared with the beginning, the only exception was with a Cotswold ewe which showed even a slight increase.

There is a great variability in the percentages of the constituents of ewes' milk, among the different breeds and individuals. The most constant constituent is the lactose, while fat seems to be the most variable. These results are in harmony with RITZMANN'S. When the average percentages of fat for five lactation periods of each ewe are determined and compared, the variation of fat content is not so marked, which indicates clearly the value of a number of tests rather than one single test on an individual. The general averages obtained by the authors during the 50 day period are shown in Tables 1 and 11.

TABLE I. -- *Average quantity and composition of milk for each breed*

BREED	Composition of milk							
	Average total quantity of milk for 24-hour periods	Specific gravity	Casein	Albumin	Non-protein	Fat	Lactose	Ash
	Gm		o	o	o	%	o	
Hampshire	2 170	1.032	3.06	0.74	0.070	7.1	4.73	0.78
Cotswold	1 558	1.033	3.10	0.74	0.065	7.7	4.78	0.82
Shropshire	1 532	1.033	3.47	0.77	0.07	8.1	4.50	0.88
Rambouillet	1 495	1.036	3.60	0.81	0.078	7.8	4.77	0.85
Lincoln	1 258	1.027	3.08	0.77	0.065	8.1	4.76	0.76
Southdown	1 238	1.033	3.45	0.79	0.066	7.5	4.70	0.91

Table I brings out clearly that the Hampshires easily ranked first in quantity of milk produced, while the differences in the other 5 breeds were not so great.

TABLE II. — *Relation of milk constituents of breeds to growth of lambs.*

BREED	Total quantity of milk	Total casein	Total albumin	Total non- proteids	Total fat	Total lactose	Total ash	Number of lambs to ewes	Total growth
	Gm.	Gm.	Gm.	Gm.	Gm.	Gm.	Gm.		Gm.
Hampshire	108 507	3 331	796	5	7 585	5 126	852	5	21 028
Cotswold	77 913	2 427	572	50	5 968	3 749	639	4	14 318
Shropshire	76 636	2 695	570	55	6 107	3 452	674	5	14 093
Rambouillet	75 110	2 677	590	45	5 797	3 624	634	5	12 488
Lincoln	63 250	1 933	480	40	5 219	2 999	386	3	10 045
Southdown	61 963	2 136	484	43	4 554	2 926	554	4	11 618

Table II shows that for one breed only, the three ewes reared one lamb each; with the others one or two ewes reared two lambs. This makes interpretation of the results less easy, as in general the same quantity of milk will produce greater gain if given to twin lambs (provided it is sufficient for their growth) than if it were given to one lamb only. It appears that the greatest factor in growth is quantity of milk, hence a high milk producing ewe is more valuable than a low one. The inherited capacity for growth, however, must not be overlooked.

1196 - *Goat Keeping in Scotland.* — *The Scottish Journal of Agriculture, Board of Agriculture for Scotland*, Vol. II, No 3, pp. 402-405. Edinburgh, July, 1919

GOATS

The fact that the word "goat" is found not infrequently in place names in Scotland from Godscroft (*i. e.* Goat's croft) to the south to Eilean na Gothail in the north, is sufficient proof that from remote antiquity the goat was an animal of no mean importance in the domestic economy of Scotland. Throughout historical times there is frequent reference to goats, and within living memory flocks of goats of some size were maintained in the Highlands. In spring the kids were separated from their mothers, which were run on pasture, and herded. Every morning and evening the mother goats came down from the hill to the kids, when the goats were milked or rather partially milked, and the kid allowed to take the rest. This went on till harvest work came on, about August, when the kids were left with their mothers and the goat milking came to an end. In those days there was a regular market for goats and the flesh was eaten generally. Most of the males were castrated, a three-year-old wether yielded 50 to 60 lb. of excellent meat. The extinction of this system was undoubtedly hurried on by the fact that goats are very destructive to trees, so that when trees began to be planted, goats necessarily had to go.

At the present time there must be a considerable number of goats in Scotland, but there are no statistics available from which even a rough estimate of the number could be drawn. First there are, especially in the Highlands, the so-called wild goats. These are not relics of an aboriginal race, but descendants of the domestic flocks. They have been deliberately maintained and in many cases even recently put on steep rocky places, as game or with the idea that they would keep the sheep from these dangerous places and so prevent losses (an idea not fully justified), or on account of the belief that goats kill adders, which is very doubtful.

In the last year or two interest in the domestic goat has been greatly revived. The number of goat-keepers in Scotland is much less relatively than in England or Ireland. Under present conditions and given the opportunity to produce at home as much food as possible for domestic use, keeping of goats would be extended if good goats could be got now at a reasonable price, but the supply is quite unequal to the demand.

Of the goats kept in Scotland the majority are of the type of the British goat. Formerly it was customary for Irishmen to come over with a drove and march them through the country selling them as they went for very low prices, but they were not of much value. There are also many goats of the foreign type, superior animals, or cross-bred to the foreign type. On account of the high cost of these animals and the care needed to keep them, good goats of the British type would prove better for the cottar and ordinary conditions as they can be fed mostly on garden rubbish and household scraps.

A really good animal will yield 4 to 6 pints of milk a day and perhaps 80 to 90 gallons a year. A more usual yield is from 3 to 5 pints a day, with a total of, perhaps, 70 gallons a year. If a goat does not give 2 pints a day at the least she is not worth keeping.

FIG 6

1197 — Pasture and Forage Crops for Pork Production in Minnesota, U. S. A. — *Minnesota Agricultural Experiment Station Report 1918*, pp. 40-51. University Farm, St. Paul 1918.

The annexed table gives the results with 4 lots of pigs fed on alfalfa and rape pastures. In contrast, unsatisfactory results are cited with 10 pigs fed on oats, peas and rape. The animals became severely rape blistered at the start, and gained only 821 lb. per acre in 96 days, or 0.35 lb. daily per pig.

Growth of shotes on pastures supplemented with maize, and maize and tankage

Pasture	Supplement	Area	Pigs	Daily	Weights per pig		Total	Time	Grain
		actually	per	gain			gain	on	required
		pastured	acre	per pig	Initial	Final	per acre	pasture	per lb. of gain
		Acre		Pounds	Pounds	Pounds	Pounds	Days	Pound
Alfalfa *	3 per cent maize	0.31	25.4	0.53	34.5	107.1	1,470	137	3.31
Do	4 per cent maize	0.30	33.3	0.66	32.1	123.6	2,438	137	3.43
Rape	do	0.50	30.0	0.74	31.1	93.4	1,809	84	1.20
Do	Maize + tankage, self fed	0.50	30.0	1.10	30.6	123.2	2,778	84	3.29

In another test the following pastures were tried. — (1) rye and rape (poor), (2) clover (good), (3) mixed and (4) alfalfa (good). The grain fed

per pound of gain was 5.46, 4.03, 5.58 and 4.52 lb respectively, and the margin of value of gain (at 16 cts. per pound) over total feed cost was in dollars 0.22, 4.26, 2.26 and 1.25 respectively.

In 2 experiments in hogging-off maize the number of hogs per acre was, respectively, 25 and 24, the gains per acre 315 and 582.6 lb., the estimated consumption of maize per pound of gain 10.52 and 5.83 lb., and the tankage fed per acre 114 and 76 lb. It is stated that the first lot remained on the maize field at least 2 days too long.

Feeding tests with fall pigs, 10 to a lot, 4 lots fed 105 days and 3, 155 days from weaning to market are also noted. One was hand fed by the Dietrich standard, the others self fed on maize mill feed, shorts and tankage, either with or without additional feed. For the lots fed the shorter period — the additional feeds, in the order of their apparent feeding value as measured by daily gain, were — (1) shelled maize and gluten feed, (2) condemned raisins, (3) none, and (4) maize gluten feed. For the longer period, the order was (1) alfalfa, and (2) none, with the hand fed (Dietrich) lot intermediate.

1198 - **Comparative Feeding Value of Field Peas and Barley for Pigs.** — *Washington Agricultural Experiment Station Bulletin 153*, pp 8-9, Pullman, 1910.

Four lots of shotes of Duroc-Jersey, Poland China and Berkshire breeding were fed 49 days in January and February, 1918, under weather conditions not favourable to feeding operations. Comparison was made between field peas (split or cracked) and shorts (2 : 1) and barley and shorts (2 : 1), supplemented either with tankage (guaranteed 60 % protein) or with linseed meal in amounts to make the supplement 10 % of the ration. The following table gives a summary of the results, the lots being arranged in the order of economy of gain

Peas v. barley for finishing pork.

Feeds compared	No of pigs	Average initial weight Pounds	Average total gain Pounds	Grain per pound of gain Pounds	Shrinkage (Pullman to Spokane) Per cent	Dressing percentage
Peas + tankage . . .	12	107.3	77.4	4.10	16.8	82.7
Barley + tankage . .	13	100.7	68.9	4.26	16.6	83.0
Peas + linseed meal . .	15	107.8	54.9	4.34	18.5	80.1
Barley + linseed meal .	13	99.8	60.6	4.77	11.7	82.0

1199 - **Use of "Luc-binh" (*Eichhornia speciosa*) (1) for Pig Feeding; Development and Prospects of Pig Rearing in Indochina.** — CHEVALIER, A. et LAPICQUE, P. A., in *Bulletin Agricole de l'Institut Scientifique de Saigon*, Year V, No. 7, pp. 220-222. Saigon, July, 1919

M. P. A. LARICOURT, Director of the Tonkin Navigation Co. of the Benthuy (North Assam) Frozen Meat Society, supplied Mr. Aug. CHEVALIER with information on the use of "luc-binh" as pig feed.

(1) See R. Sept. 1917, No. 798. (Ed.)

M. CHEVALIER relates that this plant, belonging to the Pontederiaceae, of which the scientific name is *Eichhornia crassipes* Solms, or better *Eichhornia speciosa* Kunth, the older name, is called the "Water Hyacinth" by the English colonists and "Jacinthe d'eau" by the French, these names being due to the fine spike of blue-mauve flowers standing up in the centre of a rosette of leaves. For the sake of the flowers this species is often grown in basins for ornament.

It is a native of Central America and was brought at a comparatively recent date (about the middle of the 19th century) to Indo-Malaya, where it has overrun everywhere, choking the canals and causing an obstacle to navigation. It is believed to have first appeared in Java, then to have been transported to the Malay Peninsula, whence it spread to Burmah, Siam, Cambodia and Cochin-China. It appeared at Tonkin after the Hawaii exhibition in 1904.

Today the plant is overrunning the whole of Indo China; already it has invaded a large part of tropical Asia and it is now gaining in temperate China. Few examples are known of such rapid spreading of a weed over a continent of which it is not a native.

Powerful dredging machines have had to be constructed in various countries to clear the canals of this plant which very soon fills them up. M. CHEVALIER has seen at Hanoi ponds, originally several yards deep, choked up in 15 years mainly by the "luc-binh".

Naturally, attempts have been made to use part of the "luc-binh" in various industries, and the following applications have been tried:—

(1) Suitably prepared, it makes a good textile, in Cambodia, cords are made of it for plaiting for arm chairs and deck chairs, also mats, blinds, string are made from it.

(2) It has been thought to utilise the plant, which is fairly rich in cellulose, in the manufacture of paper pulp.

(3) Recently the Burmah Agricultural Department advised its use in making a potash manure; its high potash content makes it a suitable ingredient in compost (1).

In his note, M. P. A. LAPICQUE says that M. A. ALLIER, Technical Director at Benthuy, finding difficulty at the end of September, 1918, in obtaining banana tree trunks as pig feed, attempted to use "luc-binh" as a substitute. The procedure was as follows:— Twice a day, morning and evening, women collected the plants which immediately, while in the fresh state, were broken up and cooked for 3 hours in sufficient water. To every 440 lb. of luc-binh were added 220 lb. broken maize and 220 lb. rice bran, which is sufficient maintenance ration for 250 pigs of any age, and also for breeding sows which always incline to fat, a disadvantage at farrowing time.

For a fattening ration, $\frac{1}{3}$ of luc-binh, $\frac{1}{3}$ of maize and $\frac{1}{3}$ of bran would be required.

The results obtained were very good, and the pork from pigs thus fed with luc-binh was excellent to taste. The health law inspection

authorities had no criticism to make, and for all sorts of preserves the plant appears to give the best results.

In regard to pig rearing. M. LAPICQUE adds the following additional information: —

"I should state we have imported English and Australian boars and sows of the white breed, and not without difficulty obtained sows of all the local breeds coming from Black River, Tuyen Quang, Tranninh, the Meo country, the Delta, Monkay and Pakhui. The crosses obtained give up to the present 80 % of mixed breeds which have acquired almost all the sire's characteristics. We are trying to find which cross to recommend, i. e. one having the hardness of the local breed with the early fattening qualities of the boar. Up to now the best results obtained have been by crossing Chinese sows with a pure Yorkshire boar. Pig rearing on a large scale will be a valuable resource for Cochinchina, and Indo-China offers all facilities for the purpose."

M. CHEVALIER is of the same opinion, and adds: — Indo-China, which produces abundance of rice and maize, will have at her disposal more and more in the future industrial by-products suited for pig feeding on a large scale. Besides, rural breeding such as practised by the natives may be greatly developed, no prejudice or religious cause being opposed to it as in the French Colonies in Africa. Hence France could, in the not-distant future, have considerable resources in frozen pork, salt provisions and lard from her possessions in the Far East.

1200 - **Influence of Feed on the Melting Point of Lard.** — TEMPLETON, G. S. in *Alabama College, Agricultural Experiment Station Report* 1918. p. 30-31. Auburn 1919.

The author has made an experimental study of the effect of certain concentrated feeds on the melting point of lard, in the south of the United States.

Six lots of 8 hogs were started on the experiment, but one lot had to be discarded because the ration consisting of maize, + "velvet bean and pod meal" (cake consisting of the unshelled legume *Mucuna pruriens* var. *utilis*) and tankage (4 : 4 : 1) was not acceptable. The lot fed with maize and tankage (8 : 1) dressed out satisfactorily, and produced a lard having a melting point of 44.15° C. The lot fed with maize + velvet bean and pod meal + peanut meal in the ratio 3 : 3 : 2 (not a very palatable ration) produced lard having a melting point at 42.5° C. The carcasses of the three lots fed with varying proportions of maize and peanut meal, were graded as "medium soft". In these three lots, the proportions of maize and peanut meal were respectively 1 : 1, 2 : 1, and 3 : 1, and the corresponding melting points of the lard produced were, 40.35°, 40.2° and 40.57° C.

1201 - **Case of Rudimentary Hermaphroditism in the Cock.** — FAURE, C., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXII, No. 14, pp. 519-520. Paris, May 17, 1919

The hormones secreted by the testicle determine in the animal organism the secondary sex characteristics. It is known that the absence

of the testicle, through experimental removal or its non-development, causes a series of modifications affecting the whole individual. The author quotes the case of a 3-year old cock which showed notable morphological modifications: absence of the large tail feathers, appearance resembling that of the female, but with a plumage richer than a hen's, and spurs little developed. As the animal was killed for sale, a histological examination of the internal genital organs was made, which showed a series of tubes (measuring only 40 to 50 μ in diameter, against 150 μ in a normal cock sectioned in different ways and resembling in appearance testicular formations, but totally unprovided with seminal-line cells; in no point were figures observed similar to ovary formations.

Hence, the case was that of a cock having misshapen testicles characterised by the complete absence of seminal material. This arrested growth led secondarily to the appearance of certain external female characteristics.

The author suggests the case in question may be grouped among those of rudimentary or false hermaphroditism.

1202 - **The Conformation of the Laying Hen.** — *Utility Poultry Journal*, Vol. III, pp. 24-26. Newport, Salop, 1918.

The annual conference and inspection of the trials held at the Harper Adams Agricultural College, Newport, Salop, England, in August, 1918, led to the appointment of a Committee to consider the question of drawing up a standard to which the breeders of utility stock should endeavour to make their birds conform, without sacrificing, if possible, the characteristics of the distinct breeds. With the object of obtaining data upon which to draw up such a standard, the College staff, at the request of the Committee, undertook a series of measurements in October, 1918, on the birds in a number of representative pens of the various breeds represented.

The measurements taken were. —

Conformation of body and laying capacity.

		40 eggs and over	200-240 eggs	250-300 eggs	320-360 eggs	370-400 eggs
Leghorn	Length of back	6.5 in.	6.4 in.	6.4 in.	6.5 in.	6.3 in.
	Breadth of back	3.75	3.7	3.5	3.6	3.2
	Length of keel	4	3.9	4	4.1	3.9
	Abdomen	3.5	2.7	2.8	2.4	3.1
	Distance between pelvic bones	1.2	1	0.93	0.98	0.8
	Girth measurement	14.25	14	13.7	13.8	13.4
	Wvandothe. abdomen	3.7	3.6	3.2	3.4	3
	Speckled Sussex	—	—	3.6	3.2	3.3
	Light Sussex	—	—	3.6	2.3	2.7
	Rhode Island Red	—	3.6	3.1	2.7	2.7

(1) *Length of back*, from the basal joint of the neck to the oil gland at the base of the tail, (2) *breadth of back*, taken between the inside of the

fingers when spanning between the depressions on the hips; (3) *length of keel*, from fore end to hind end; (4) *abdomen*, from the end of the keel to the pelvic bones; (5) *distance between the pelvic bones*; (6) *girth measurement*, taken by passing the tape completely round the bird in the same position as the measurement for breadth of back, the legs of the bird being directed backwards.

The subjoined table gives the averages of each of the 6 measurements for Leghorns, and only the averages of the 4th measurement for the other breeds, as this figure seems most indicative of laying capacity.

1203 - Effect of Certain Grain Rations on the Growth of the White Leghorn Chick. —

DAVIS, BUCKNER G., NOLLAN, E. H., WILKINS, R. H. and KASTLE, J. K. (Department of Chemistry, Kentucky Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XVI, No. 12, pp. 305-313, Washington, D. C., March 24, 1919

These experiments were carried out in order to ascertain the insufficiency of the proteins of rice, oats, barley, hominy and gluten flour in promoting normal growth in the white Leghorn chick.

Three lots of 60 White Leghorn chicks each were kept under identical conditions except that the diets were different. Lot 1 was fed a ration consisting of equal parts of finely ground soybeans, wheat, wheat bran, sunflower seed, and hemp seed. Lot 2 received a ration consisting of equal parts of finely ground barley, rice, hominy and oats to which was added enough gluten flour and butter fat to raise the protein and fat content to that of Lot 1. Lot 3 (control) received a ration known as the standard Cornell ration (1).

Table I presents the weekly weight and mortality records of these three lots of chicks, covering a period of 28 weeks, in which time there were no unusual weather conditions or epidemics among these chicks, so that these figures represent the degree of nourishment afforded by the rations fed to the separate lots.

The following deductions are made from these experiments:—

The proteins of rice, oats, barley, hominy, and gluten flour are inefficient in promoting normal growth in the White Leghorn chick. It was not possible at this time to show wherein these proteins are limited, but the writers hope to be able to prove this by experiments which are now in progress. These proteins seem to have a retarding action on the development of the external sexual characteristics and their functions, which accompanies the arrested growth of the chicks.

The apparent weakened vitality of the chicks of Lot 1 is not attributed to any toxic action of the soybean.

(1) Cf. NIXON CLARA, Feeding Young Chickens. N. Y. State College of Agr., Cornell Reading Course, Vol. 4, No. 88, p. 176, 1915

TABLE I. — *Effect of various diets on the growth of White Leghorn chicks.*

Week	Lot I				Lot II		Lot III (Control)			
	Average weight of			Number of Chicks	Average weight of cocks and hens	Number of chicks	Average weight of			Number of Chicks
	25 cocks	17 hens	Mean				25 cocks	17 hens	Mean	
	Gm.	Gm.	Gm.		Gm.		Gm.	Gm.	Gm.	
0	41.0	39.4	40.2	60	41.8	60	42.1	41.1	41.6	60
1	70.4	66.5	68.4	56	52.2	59	72.2	69.2	70.7	55
2	100.9	6.8	98.8	55	66.1	54	109.7	95.6	102.6	53
3	146.5	137.7	142.6	55	76.3	52	161.4	140.9	151.1	53
4	184.1	179.9	181.6	55	89.2	50	231.6	191.7	211.6	53
5	206.6	235.5	246.5	55	98.8	46	292.2	248.8	270.5	53
6	296.5	276.3	286.5	55	106.9	45	360.9	238.3	324.6	52
7	363.4	318.5	340.9	53	124.3	37	442.8	354.4	398.6	52
8	240.0	382.5	401.5	52	148.6	35	496.9	395.6	440.2	52
9	470.0	423.1	447.5	53	154.1	34	537.1	409.9	473.7	51
10	518.2	460.9	489.5	49	162.5	24	630.9	488.7	559.0	48
11	583.5	523.7	556.1	48	182.3	22	174.4	506.4	590.4	48
12	653.4	582.4	617.9	47	221.0	21	812.9	622.2	717.5	48
13	733.4	635.9	684.6	46	244.3	21	902.3	682.4	792.3	48
14	795.8	684.2	740.0	45	251.1	21	953.2	695.1	824.1	48
15	828.4	740.1	784.2	45	293.4	20	980.4	717.3	848.8	48
16	954.9	790.6	872.5	45	325.6	20	1063.2	780.9	922.1	46
17	1024.5	844.2	934.3	5	361.5	20	1154.9	841.8	998.3	46
18	1077.8	930.6	1004.2	45	441.1	20	1252.7	889.4	1071.0	46
19	1135.9	964.0	1050.2	44	474.6	19	1295.3	922.9	1190.1	47
20	1184.6	1010.2	1097.4	44	521.4	19	1244.8	956.2	1150.5	47
21	1231.6	1057.3	1144.4	44	543.7	19	1396.8	992.2	1194.4	47
22	1214.5	1055.8	1135.1	44	505.8	19	1430.6	1038.4	1234.5	47
23	1204.0	1101.1	1152.8	44	615.0	19	1442.0	1047.6	1245.1	47
24	1215.5	1020.3	1154.9	44	663.8	19	1462.1	1066.2	1264.2	47
25	1106.7	1020.3	1143.0	44	734.3	19	1480.0	1082.6	1281.3	45
26	1268.0	1084.5	1126.5	44	763.7	19	1528.5	1075.4	1301.9	43
27	1250.4	1135.3	1192.8	42	781.9	19	1560.0	1090.2	1325.4	43
28	1294.3	1182.6	1238.4	42	809.4	19	1594.6	1120.4	1357.5	42

1204 - **Egg Weight as a Criterion of Numerical Production in the Domestic Fowl. —**

HADLEY, P., in *Journal of the American Association of Instructors and Investigators*, summarised in *Ugby Poultry Journal*, Vol. IV, No. 7, p. 23, Harper Adams Agricultural College, Newport, Salop, 1919.

The author undertook an enquiry to ascertain whether computation based upon the weighing of only 10 eggs laid as closely as possible to the periods of the absolute vernal and autumnal maxima respectively would afford a satisfactory basis for computing the weight production correlations. This was attempted first for the period of the vernal maximum. To this end, the mean weight of 10 eggs laid by each member of the flock between April 11 and 25 was computed, and the difference between the mean weight of these ten eggs and the mean weight of the first 10 eggs

laid by that hen at the beginning of her first laying year calculated as a percentage increase or decrease. The April production was very rapid; 28 out of 37 hens laid 10 eggs within the dates mentioned, and the others in only slightly longer time. In no instance was it necessary to pass the limits of April 8, or 29. The data show that the small group of hens characterised by a percentage increase in egg weight of more than 10 gave a higher mean production (142 eggs) than any group with a smaller percentage of increase in egg weight.

Each succeeding group, characterised on a smaller percentage increase, gave a correspondingly smaller annual production, down to the group manifesting a decrease in mean egg weight, with a mean annual production of only 106 eggs. Dividing the flock as the mean percentage of increase is more or less than 6, there result 13 hens in the high percentage group with a mean annual production of 138 eggs, and 24 in the low percentage group with a mean production of 109 eggs.

In view of these results it seemed desirable to ascertain whether the method would apply also at the autumnal weight maximum in September. During the latter month, in contrast to April, 4 hens did not lay at all, while 3 laid only 3 eggs or less, so that no records are included of hens that did not lay at least 5 eggs in September. Again, the production at this period was scattered as compared with that in April. Often, eggs laid in the earlier part of the month had to be included, instead of only those laid during the latter half of the month.

From the September data it appears, as in the former case, that higher production is correlated with the higher percentages of increase in egg weight. The maximum group production (147) occurred in those hens whose increase in mean egg weight was above 13 %. Selecting above 10 % gave 7 birds whose mean production was 143 eggs. Selecting above 6 % gave 12 hens whose mean production was 139 eggs. On the other hand, selecting below 0 % (birds showing decrease in egg weight) gave 5 hens with a mean production of only 108.

Hence the innate egg-producing ability of a hen is manifested, not only by the number of eggs laid within a year or some longer or shorter period, but also by the degree of increase or decrease in the mean weight of her eggs, when this increase or decrease (calculated as percentage -- increase or -- decrease) is measured at those periods of laying (the vernal and autumnal maxima) characterised by the markedly increased production of the flock. On this basis, groups of hens can be differentiated as accurately as, and more easily than, by any other means.

1205 - Experiments on the Feeding Value of Whale Meal for Poultry (1). — *Utility Poultry Journal*, Vol. IV, No. 6, pp. 19. Newport, Salop, 1919.

This experiment was conducted with the idea of testing the feeding value for egg production of whale meal. For the purpose of the experiment four Leghorn pullets and a cockerel were used. They were penned in a small enclosed run with a small scratching shed house attached.

(1) See also *R.*, July-September, 1919, No. 1009. (Ed.)

The birds were fed three times per day, viz., at 7 a. m., with a mixture of grain consisting of wheat, oats, and maize; at noon they were given their warm mash consisting of the following mixture: Whale meal (scalded), 1 part by weight — clover meal (scalded) 1 part — bran (scalded) 1 part — oat meal or sharps 4 parts. The oat meal and sharps were fed on alternate days. The quantity of food given averaged 2 oz. of grain and 2 oz. of dry meal per day per bird. At 4 p. m. the birds were again given a feed of the grain mixture, as in the early morning. The grain was fed in scratching litter and the soft mash in troughs. The whale meal was used in the same proportion as fish meal had been used previously, and was made to substitute it entirely from the date of the commencement of the experiment.

During the 31 days' trial (from April 5 to May 5) the weights of the birds showed a slight average increase. The four pullets laid 101 eggs, giving an average per bird of 25.25 eggs for the period. The eggs produced were all over 2 oz in weight and did not develop any tainted flavour from the whale meal.

After the first day the birds took to the new food readily and were always eager for their mash afterwards. The rather strong smell of the meal probably put them off for the first day.

Conclusions. — The results obtained show that whale meal may be used as a substitute for fish or meat meals and that no detrimental effects are produced either upon the birds themselves or the quantity or quality of the eggs produced.

A comparison of the chemical composition of the product with that of ordinary fish meal or meat meal is distinctly favourable to the extended use of the product now reported upon. A crude protein content of 34 per cent or more indicates that the poultry-keeper would be justified in the use of the meal, similarly to fish meal, as a protein concentrate. A crude fat content of 16 per cent. corresponds very closely with that of a grade of fish meal rich in fat. The ash content being noticeably similar to that of these better known products and including 24 per cent. of calcium phosphate would appear to indicate equal suitability to the needs of growing stock while a negligible percentage of salt in the whale meal will appeal to the poultry-keeper who has had experience with brands of fish meal that contain excess of this undesirable ingredient.

1206. — **Cotton Seed Meal as a Poultry Food (1): Experiments in North Carolina, U. S. A.** — KAUPP, B. F., in *Journal of the American Association of Poultry Instructors and Investigators*, Vol. 5, summarised in *Utility Poultry Journal*, Vol. IV, No. 7, pp. 23-25. Harper Adams Agricultural College, Newport, Salop, 1919.

The author experimented for a period of 5 years at the North Carolina Experiment Station on the effect of cotton seed meal as a poultry food. The conclusions arrived at are given below.

Cotton seed meal contains gossypol, which in turn contains two pigments: — (a) a brown resinous substance; and (b) a yellowish crystallisable

(1) See also R, 1918, Jan, No. 64; March, No. 306; April, No. 443; June, N 663, July, No. 734. (Ed.)

substance. The pigment of gossypol is stored to a greater or less extent in the fat of the yolk of eggs by hens consuming the meal.

Gossypol to the amount contained in an ounce of cotton seed meal, consumed daily by adult fowls, produces injurious effects such as pendulous crops and depraved appetite, the latter leading to the eating of sticks and pieces of litter (as straw), resulting in impaction and the death of the fowl. If the total food consumed consists of 30 % cotton seed meal, there are likely to be ill effects and some deaths due to the meal. If the cotton seed meal be given in the mash alone, and the birds are given a morning and evening scratch feed and in addition allowed more or less range so that they can forage more feed, the effects are not nearly so bad, as, if they get sick of the meal, they will have a chance to "lay off" for a while and later return to it. This seems to account for the different opinions on the feeding of cotton seed meal. Birds eating excessive amounts of cotton seed meal or its gossypol apparently die from emaciation and starvation owing to the fact that they refuse feed.

Twenty per cent. cotton seed meal in broiler fattening proved unsatisfactory, and the same results were obtained in cram feeding work of old hens. In two of the 3-year-old feed tests the highest percentage of deaths was from the cotton seed meal lot. It is generally conceded that high percentages of cotton seed meal and of linseed meal cause a higher death rate than many of the higher concentrates.

There are marked differences in individuals as to their tolerance of cotton seed meal. Heating the meal to a high temperature has a tendency to lessen its injurious effects. The feeding of large amounts of the meal has no ill effects upon the progeny. Fed to young chicks in quantities not over 10 % of the mash it has given good results. It is high in globulin, a protein stimulative to growth and development, also in alkali-soluble protein, likewise stimulative to growth.

The limit of safety in feeding cotton seed meal for all purposes to fowls is perhaps about 10 % in mash, allowing the birds to feed twice daily in addition.

4207 - Castor Bean Meal as a Poultry Food ; Trials at the Harper Adams Agricultural College, Newport, Salop, England. — ATKINSON, H T, in *Uthty Poultry Journal*, Vol. IV, No. 3, p. 21. Newport, Salop, 1919

Six cockerels were given food consisting of 1 part castor meal and 5 parts mixed meal (sharps, ground oats, etc.) at the rate of 4 ½ to 5 oz. per bird each day ; a little grain food was given in addition, and grit and water were also available. The birds ate the food eagerly but steadily lost weight, and after about 10 days they began to look unhealthy. At the end of 36 days one bird died, and four days later another. Forty days later ordinary diet without castor meal was given and the remaining birds slowly recovered. The total loss in weight over the period was 7.25 lb., or 1.21 lb. per bird. Post-mortems of the dead birds disclosed the ordinary symptoms of poisoning.

The conclusion is that castor meal should be rigorously excluded from

mixed meals and in buying these feeds the poultry keeper should make sure that no castor is included in meal purchased.

1208 - **Final Report of the 5th Poultry Egg-Laying Trials, 1917-18, at the Harper Adams Agricultural College, Newport, Salop, England.** — *Utility Poultry Journal*, Vol. III, pp. 7-11. Newport, Salop, 1918.

The trials lasted from Oct. 21, 1917 to Oct. 20, 1918 in the small flock section and from Nov. 11, 1917 to Nov. 10, 1918, in the large flock section.

The total results are shown in Table I, and comparisons with the returns of previous years in Table II.

In the 1917-18 trials, the best pen, that which gave the maximum weight of eggs, laid 1351 (225 per hen), while the worst gave 428 (71 per hen). The maximum number of eggs per group was 1418 or 235.5 per hen. No account was given of the relation between weight of bird at beginning of trials and proportion of big eggs (weighing over 2 oz.) to small eggs (under 2 oz.) laid. It is often the most active birds that give a larger proportion of small eggs. Of the hens that laid 250 eggs and over, the two with the largest number of small eggs were hatched 2 weeks after the others in the same group. It appears that there may be a period previous to the beginning of laying when it is essential to keep the birds in a thriving condition so that the egg-producing organs may be developed properly. The number of deaths was generally low—4%, of which 3.1% was of other breeds than the White Leghorns and White Wyandottes. This is a new proof of the inexactitude of the claim that breeding for greater egg-production causes loss of stamina. The quantity of foods consumed daily per bird was 2 oz. meals (in mash) and $1\frac{2}{3}$ oz. grain, with vegetable additions (swedes, cabbage, potatoes and lawn mowings), grit and shell. The total weight of eggs was 11 582 lb. and the total weight of meal and grain consumed was 48 000 lb., or 1 lb. of eggs was obtained for each 4.2 lbs. of food.

TABLE I. - *Egg-laying trials 1917-18, total results.*

BREED	No of birds	Total No of eggs	Average weight per egg oz.	Average per bird
Leghorns	216	31 928	2.04	147.8
Wyandottes	198	34 271	1.97	173.1
Rhode Island Reds	54	7 947	2.04	147.1
Orpingtons and Rocks	48	6 443	2.04	134.2
Sussex	48	5 661	2.04	117.9
Other breeds	42	5 510	2.05	131.2
<i>Totals and averages</i>	606	91 760	2.03	141.9

TABLE II. — *General results of previous trials.*

	1912-13	1913-14	1914-15 (10 months only)	1915-16	1916-17
Number of birds in trial. . . .	600	300	300	600	354
Total No. of eggs laid. . . .	91 115	56 184	50 562	98 898	52 638
Average No. per bird. . . .	151.9	187.28	168.5	164.8	148.7
Best pen: No. of eggs. . . .	1 389	1 339	1 272	1 513	1 496
Worst pen: No. of eggs. . . .	326	615	748	471	537

1209 - **Sex, Reproduction and Heredity in Pigeons.** — *Nature*, Vol 103, No. 2596, pp. 436-437, London, August 2, 1919.

Dr. Oscar RIDDLE has previously brought forward evidence to show that male pigeons arise from eggs (yolks) of less storage metabolism, which implies small size and higher (oxidising) metabolism, and that females arise from eggs (yolks) of greater storage metabolism, which implies large and lower (oxidising) metabolism. He has now (*Journal of Experimental Zoology*, Vol. XXV., 1918, pp. 227-254) studied two cases of female "identical twins," and seeks to show that the ova (yolks) which produced both of them were extraordinarily and abnormally large. Dr. RIDDLE's evidence is necessarily indirect. The eggs when laid were very large compared with all the other eggs produced by the particular parents (totals of 116 and 134 eggs). Double-yolked eggs in doves are practically restricted in their production to hybrids from wider crosses, or to birds showing striking reproductive abnormalities, or to both of these, and would not be expected to appear in the series in which the two cases of "identical twins" were found.

It is suggested that the blastoderm-borders will be abnormally raised in extraordinarily large eggs, and abnormally lowered in extraordinarily small ones, and that this might lead, for physical reasons, to the establishment of two independent foci of development. If male "identical twins" were found developing from a very small egg, it would be an interesting corroboration of the author's theory. Meanwhile, he thinks that the available data point to the conclusion that each pair of female "identical twins" arose from a single ovum of high storage metabolism.

In healthy doves and pigeons the right testis is larger than the left in a very high percentage of cases, yet in the female it is the left ovary that persists. The left testis more nearly approaches the ovary than does the right. In disease, particularly in tuberculosis, the testes undergo extreme atrophy, but more in the right than in the left; the ovary does not seem to suffer reduction in size. The right testis of the very young birds (from embryos to squabs a few weeks old) is normally longer than the left. The single (persistent) left ovary of young female squabs is twice, or more than twice, as long as is either testis in males of similar age (three to seven weeks). Now Dr. RIDDLE finds (*Anat. Record*, Vol. XIV., 1918,

pp. 283-334) that in hybrids the normal size relations of the two testes are often disturbed, sometimes reversed, approximating to the female condition. The number of such reversed cases increases as the width of the cross. The excess of males from such crosses is also known to increase similarly, e. g. when the crosses are between members of different genera. The theory suggested is that "sex has been controlled in these forms, and that a male which is forced to arise from a female-producing egg may show in the relative size of its gonads an approximation to the relative size of the gonads of a female."

Dr. RIDDLE and Mr. Carl F. ANDERSON (*American Journal of Physiology*, Vol. XLVII., 1918, pp. 92-102) gave ring-doves small doses of quinine sulphate, and found a marked reduction in the yolk size and total size of the eggs. It is well known that quinine reduces the destruction of nitrogenous components of the tissues, and probably checks the secretory activity of the oviduct, the product (albumen) of which is entirely of a proteic nature. Furthermore, the presence of quinine in the yolk of the eggs probably checks the characteristic transformation of the nitrogenous compounds; the eggs are poor in yolk for some weeks after the dosage is discontinued.

From an egg produced by a pigeon under the weakening influence of "reproductive overwork" there was hatched in 1914 a female bird which might be called an ataxic mutation. Dr. RIDDLE describes the bird (*Proceedings of the Society of Experimental Biology and Medicine*, Vol. XV., 1917, pp. 56-58), which showed when young a marked lack of power over the voluntary movements of the head and body. The affected female was bred to two different males, and the derangement was seen through four generations descended from either. Of 175 young ones reared to the age at which the disorder might be exhibited 9 were classed as normal and 46 as affected. With some irregularities the character appears like a Mendelian recessive.

In a study of the brains of the "ataxic" pigeons (*American Journal of Physiology*, Vol. XLVII., 1918, pp. 124-36) Miss Mathilda L. KOCII and Dr. RIDDLE report that, as compared with normal birds of the same parentage, there are increased values for moisture, protein and extracted sulphur and decreased values for lipoids, phosphatids, and cholesterol. The results of the analyses are interpreted as suggesting a chemical under-differentiation or immaturity of the disordered brains.

Dr. RIDDLE and Mr. Victor K. LA MER report (*American Journal of Physiology*, Vol. XLVII., 1918, pp. 103-123) a remarkable fact which must be considered in connection with theories of colour-inheritance, namely, the postmortem formation of melanin in the pigmentless retinas and choroids of embryo white ring-doves of 3-12 days of development. Killing the tissues in HgCl_2 does not prevent the production of the pigment, but the presence of free oxygen is necessary.

1210 - Bee-keeping in Syria and Lebanon. — BALDENSBERGER, R. P., in *L'Apiculteur*, Year LXIII, No. 8, pp. 189-192. Paris, August, 1919.

BEE KEEPING

The author describes observations made at Beyrut and in all the region where he travelled or stayed in Syria and Lebanon.

The nectar-producing flora around Beyrut is not of a high order because mulberry trees, and consequently silk worms, take the foremost place. Sometimes gardens are hedged with Barbary fig trees (*Puntia vulgaris*) of which the second reddish-yellow flowers offer the bees a large quantity of yellow pollen, with sweet nectar, even too sweet, as the honey soon becomes crystallised in the cells. The prolonged summer offers nothing more, and without sugar at a very moderate cost the bee colonies, always weakened by continuous renewing of the queens, could not be kept going.

Thyme is a slight resource, but it grows at too great a distance away for small colonies, the members of large colonies not going further afield than 2 miles at most.

The town of Saïda or Sidon, about 25 miles south of Beyrut, with its vast orange groves, is infinitely superior to Beyrut for bee-keeping, but even it is second to Jaffa, where the species of orange tree growing there yields an incredible quality of nectar. The Jaffa orange tree, when transplanted to other places, even to Palestine along the coast, degenerates and never yields so much as it does on its native soil.

The Syrian bee differs slightly from the Palestine one. It is very like the yellow Cyprus bee, but all three are almost equally vicious when disturbed. The pale-yellow Palestine bee resembles the grey-yellow Egyptian.

French bee-keepers, who have begun to settle in Syria, will do well to provide themselves with a good smoker before approaching the bees, and never to disturb them except when really necessary and even then only for a very short time. Like all oriental bees, the Syrian is always very lively, fights vigorously against hornets and wasps, starts early and retires late and keeps excellent lookout round the hive. It builds quantities of queen cells when queenless or forced to swarm, and is valuable in respect that it does not destroy the superfluous cells for some hours; often a queen cell may be found even 24 hours after the first virgin queen has hatched out.

Bee disease (loque) is unknown to the inhabitants of the country, and during the 2 seasons the author spent at Beyrut and Lebanon he never came across it, any more than during his ten years of bee work further south and in Palestine.

A grey scaly lizard, the agania (*Ligama stellio*), very useful to agriculture generally for destroying insects, is very harmful to the bee colonies.

The author makes an interesting general remark. While the works of notable writers (HUBER, LANGSTROTH, DOOLITTLE, etc.) state that 48 hours elapse between the successful nuptial flight and the appearance of the first eggs, he has always held that the period is 4 days. Without denying the possibility that the queen, in exceptional cases, may be able to lay in 48 hours' time, he is convinced, after 38 years' prolonged observ-

ation, that in the great majority of cases it is only after twice that length of time that laying begins. On the other hand there are many causes which hinder or hasten the exit for the nuptial flight, and the author has observed that it is within 1 to 35 days after birth that the queen went out, without however having a bad effect on the laying. The great majority of matings takes place generally between the 7th and 10th day. The author has made his observations on hundreds of cases, seeing that he only rarely keeps queens beyond 18 months or 2 years at most, and replaces them with fresh ones before the decline.

1211 **Nosema Dise se.** WHIFF, G. F, in *U S Department of Agriculture, Bulletin* No. 780, pp. 59 | Bibliography of 17 titles Washington, June 12, 1919

Until 1909 the existence of *Nosema* infection (1) among bees was not generally known to beekeepers, although it had been studied somewhat by DONHOFF (1857) about a half century earlier ZANDER began his studies a decade ago and since the appearance of his first paper (1909) a number of investigators have made studies on the disorder. The writer began the study of *Nosema* infection in 1910 following the demonstration by him that the disorder exists in the United States. In these studies the effect of the disease on colonies and on apiaries, the transmission of the disease, the resistance of the infecting germ to heat, drying, sunlight, fermentation, putrefaction, and disinfectants, and the effect of drugs on the disease are among the problems which have been considered. An earlier paper (1914) briefly summarises the results obtained from these studies. The present bulletin gives all the results obtained from them which are believed to be of direct practical value to the beekeeper.

The following statements seem to be justified from the facts recorded in the present paper. —

Nosema-disease is an infectious disorder of adult bees caused by *Nosema apis*. The disease is not particularly malignant in character. Adult workers, drones, and queens are susceptible to infection, but the brood is not.

The infecting agent, *Nosema apis*, is a protozoon that attacks the walls of the stomach and occasionally those of the Malpighian tubules. A colony can be inoculated by feeding it syrup containing the crushed stomachs of infected bees. One tenth of the germs present in a single stomach are sufficient to produce marked infection in a colony. Within a week following the inoculation the parasite can be found within the walls of the stomach. Before the close of the second week infection can be determined by the gross appearance of the organ.

The disease can be produced at any season of the year by feeding inoculations. Infected bees may be found at all seasons of the year, the highest percentage of infection occurring in the spring.

Nosema infection among bees occurs at least in Australia, Switzer-

(1) Known in England as Isle of Wight disease (Ed)

land, Germany, Denmark, England, Canada, and the United States. This distribution shows that the occurrence of the disease is not dependent altogether upon climatic conditions.

The course of the disease is not affected directly by the character or quantity of food obtained and used by the bees. A sluggish body of water supply, and the robbing of diseased colonies must be considered for the present as the probable sources of infection. The transmission of the disease through the medium of flowers is not to be feared. The hands and clothing of the apiarist, the tools used about an apiary, and winds need not be feared as means by which the disease is spread. Hives which have housed infected colonies need not be disinfected and combs from such colonies are not likely means for the transmission of the disease. Bees dead of the disease about the apiary are not likely to cause infection unless they serve to contaminate the water supply.

Nosema apis suspended in water is destroyed by heating for 10 minutes at about 136° F. (58° C.) Suspended in honey, it is destroyed by heating at about 138° F. (59° C.) *Nosema apis*, drying at room and outdoor temperatures, respectively, remained virulent for about 2 months, at incubator temperature about 3 weeks, and in a refrigerator about 7 ½ months. It was destroyed in the presence of fermentative processes in a 20 per cent. honey solution in 3 days at incubator temperature and in 9 days at outdoor temperature. In a 10 per cent. sugar solution it was destroyed in from 7 to 11 days at room temperature. It resisted putrefactive processes for 5 days at incubator temperature, for 2 weeks at room temperature and for more than 3 weeks at outdoor temperature. When dry it was destroyed in from 15 to 32 hours by direct exposure to the sun's rays. Suspended in water it was destroyed by exposure to the sun's rays in from 37 to 51 hours. If suspended in honey and exposed to the sun's rays, frequently it will be destroyed on account of the temperature of the honey which results from the exposure.

Nosema apis remained virulent in honey for from 2 to 4 months at room temperature. In the bodies of dead bees it ceased to be virulent in one week at incubator temperature, in 4 weeks at room temperature, in 6 weeks at outdoor temperature, and in 4 months in a refrigerator. In the bodies of dead bees lying on the soil it ceased to be virulent in from 44 to 71 days.

Nosema apis is readily destroyed by carbolic acid, a 1 per cent aqueous solution destroying it in less than 10 minutes. The time element which by the experiments is shown to be sufficient for the destruction of *Nosema apis* should be increased somewhat to ensure their destruction in practical apiculture.

The prognosis in *Nosema*-disease varies markedly from excellent in case of strong colonies with a comparatively small percentage of *Nosema*-infected bees to very grave in case of weak ones with a high percentage of infected bees.

From a technical point of view the results here given must be considered as being approximate only. They are, however, in most instances sufficient for practical purposes.

SILK CULTURE

1212 - *Sericulture in Indo-China* (1). — VERNET, G. (with introduction by M. CHEVALIER) in *Bulletin Agricole de l'Institut Scientifique de Saigon*, Year I, No. 6, pp. 161-171. Saigon, June, 1919.

I. — INTRODUCTION BY M. A. CHEVALIER. — Of all tropical countries, Indo-China is certainly the one where in the last few years the greatest efforts have been made to develop sound methods of silk-worm rearing and to improve the quality and production of silk.

Most important results have been achieved but they are known only to a very restricted colonial public, as they are not apparent on the surface: the well-being of the natives having improved, a great part of the extra silk-production is consumed on the spot, so that exports of this material have risen little, and it will continue so for some time to come. Also, it must not be thought that silk production can be indefinitely increased.

Rearing of silk worms and silk working in the home are poorly paid operations which can be undertaken only by the poor class of natives in the time when they are not occupied in growing food crops. Besides, it is necessary for these natives to have the use of land suitable for growing mulberry trees on. As agriculture gradually develops in the rich parts of Indo-China and as European crops absorbing labour are more extensively grown, the production of silk will slowly diminish in these parts. On the other hand, French penetration into the high regions of Cambodia, the Annam Chain, Laos, and Tonkin, should result in enabling the mountain population of these regions to engage in rearing the silkworm moths, silk being one of the easiest materials to export from distant countries badly off for means of transport.

Just now it is in the middle region of Tonkin and in Middle Annam that the greatest efforts have been made to develop silk-worm rearing. At present, the propaganda is being extended also to Cambodia and Cochin China. Finally, at the request of the French Chamber of Commerce at Shanghai, the French Government in 1917 put a French specialist, Mr. P. VIEIL, at the disposal of the Chinese Government.

Improvements to be brought about in Indo-China come under 5 heads: —

(1) Fight against the spread of diseases, especially by distributing to the natives sound eggs previously examined in the laboratory.

(2) Selection among the existing varieties of silk worms in each country in the Union, and procuring new varieties having a higher silk yield and greater resistance to disease.

(3) Improvement of mulberry trees by spreading varieties that

(1) The *Review* for Nov. 1918, summarised in No. 1264, under this title, the paper brought by M. A. GACHON before the 1918 Congress of Colonial Agriculture (Previously in Sept. 1912 in No. 1330, this *Review* gave an outline of a paper by M. LEMARIE, entitled "Silk in Indo-China"). The paper reviewed here is a useful complement to the question. A very interesting paper by M. BUI-QUANG-CHHOI on sericulture in Indo-China, which appeared in the *Bulletin économique de l'Indochine* (1913, New Series, No. 10, March-April, pp. 164-178, and No. 102, May-June, pp. 376-401) should be noted, as it acts as a preface to these papers: it gives a historical outline of sericulture in Indo-China and describes the methods followed by the natives. (Ed.)

resist disease and give a high yield of leaves all the year; most of the mulberry trees grown in Indo-China are varieties of *Morus indica* L. with small lobed leaves; at Tonkin a large-leaved variety was recently introduced which belongs to the *Morus alba* L. group, most grown in China; it gives very good results in the Middle region and on the mountains, but perhaps may not retain its good qualities in warmer countries.

(4) Improvement in the methods of winding off cocoons and preparing the silk.

(5) Propaganda among the natives with a view to extending a sound silk producing industry, especially in regions where it has not yet a footing.

Mr Daniel ZOLLA lately wrote that silk production could easily be increased ten fold in Indo-China; only by resolutely carrying out the annexed programme can this end be attained. It is of no use at all for the purpose to send natives to France to be instructed so as to become teachers; they have before them in Indo-China itself the model silk-worm nurseries of the local agricultural services which bear comparison with the best-organised establishments of the south of France, while the microscopical examination of the worms so as to eliminate the eggs of individuals suffering from pebrine is done with the greatest care by native assistants.

II. M. G. VLKNET'S PAPER. — This paper is devoted to the second point in the programme laid down by M. CHEVALIER, viz., selection among the existing varieties of silk-worms in the country and obtaining new varieties having a higher yield of silk and greater resistance to diseases. The paper shows that the problem has not been lost sight of.

The author studies in succession the statistical data, ordinary and pedigree selection, the methods of silk worm rearing and crosses, and he finally reaches the following conclusions:—

Is it possible to obtain similar results with all the Indo China varieties of silk worms? This is what experimental studies, if methodically conducted, will allow of deciding rapidly. It is probable, however, that certain crosses will be better than others.

The main points to which attention should be drawn in practical sericulture are:— regularity, size, colour and richness in silk of the cocoons, as well as early maturity and resistance to disease in the silk worms.

In France, the rearing of cross breeds is not generally taken up, while the contrary is the case in Italy. It is in France, however, especially in the Upper Alps, that the best crosses from eggs intended for use in trans-Alpine rearing are made. Certain combinations of hybrids of the 1st generation have acquired a first-class reputation.

It is, therefore, certain that Italian rearers find it to their advantage to get from a distant part their eggs which, to have their full value, seem need to have been produced under very special conditions. The results obtained at Suôi-giao are encouraging from this point of view, as only Indo-Chinese varieties were crossed which were well adapted to the general conditions of the country.

The study of the dissociation of the hybrids shows that, in order to deliver to the rearers eggs giving homogeneous results as to colour of co-

cocoons, only eggs of the 1st generation may be delivered or else eggs from hybrid disjunction products which have fixed characteristics considered as desirable.

Continuous production of hybrids of the 1st generation is easily done, but requires a special organisation. It necessitates that mulberry plantations and silk-worm nurseries be annexed to the egg-collecting establishment, for the regular production of pure breeds which must constantly be crossed with one another. As the life cycle of the different breeds varies to a fair extent in its duration, the birth of the moths must be arranged for daily. The starting point will be easily got by putting in an ice safe the primary eggs, of which a small proportion will be used each day, up to the complete building up of the rotation rearing of which the pure-bred moths will permit of the regular crossing necessary for the continuous production of eggs. The separation of male and female cocoons is easily done by the well-known process of trial by the balance. The female cocoons are heavier than the male ones. The distinctive sex signs on the worms are not very visible in the native breeds.

A number of cross combinations may be of interest, but it will be important to deliver the eggs to the rearers only after a strict trial. It is thus that studies of the biometric curves of F_1 crosses and of the dissociation of the hybrids will be able to be of practical use, which will greatly help Indo-Chinese sericulture.

1 BREEDING 1213 — **Biology of the Eel.** — GRASSI, B., in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series V, Vol. XXVIII, Nos. 9-10, 1st Half-year, pp. 313-319. Rome, May 4 and 18, 1919.

The author gives a summary of a study he made on the subject of the natural history of the eel, which will be published later.

SCHMIDT maintained that the eel does not breed in the Mediterranean and that the leptocephali brevirostres (larval, according to the author's nomenclature) of the Mediterranean always originate in the Atlantic. The author shows that, contrary to SCHMIDT's statements the leptocephali brevirostres (1) also live in the Ionian Sea; (2) live in the Mediterranean even during winter; (3) in winter are not on the average longer there than those found by SCHMIDT in the neighbourhood of Gibraltar at the same season; (4) between the formation of the ovum and the elver stage (embryo, pre-larval, larval and semi-larval periods) certainly not more than a year elapses; and (5) the leptocephalus brevirostris, from the first moments of its metamorphosis and probably even before, gives evident signs of preferring the deep as if it belonged to the sea bottom, and it can embed itself in the sand. It has not, therefore, been proved that it lives an exclusively inshore life. The fact that, at Messina, individuals in metamorphosis have scarcely ever been captured before the 6th stage agrees with this circumstance.

Other experiments by the author prove that eels of the Adriatic lagoons do not go to the Atlantic. The opinion that these eels are distinguishable in size from those of the Straits of Messina has no foundation.

Measurements of some thousand elvers, arranged as to period of growth and date of catching, lead the author to conclude : (1) that the elvers of the Atlantic attain a greater mean length than that of the Mediterranean elvers ; (2) that the mean length, in the same period of growth, is greater, in October and November and gradually diminishes during the following months : the mean difference between the first and the last months varies between 5 and 6 mm. ; (3) that in some years the mean length in the different months keeps constantly a little below that of other years. The lept. brevirostres are also smaller in February and March than in the following months, but apparently it should not be taken that they grow in time, while numerous facts sustain the idea that the small leptocephali brevirostres become small elvers and reciprocally the big ones big elvers. On this basis it follows that it is not the greater or lesser length of the leptocephali taken in the Mediterranean which counts for or against the origin of the leptocephali in the Atlantic. The author admits that their size may be due to the temperature of the water in which they grow.

At Pisa and Leghorn the percentage of individuals with the lower part of the tail deeply cut in is constantly lower than that found at Fiumicino, Naples, Comacchio and in the Atlantic. Correlations based on body measurements reveal also differences between the eels of Sicily and those of Pisa, but the author does not attribute to this any special importance, as it is not impossible they may be due to differences of environment posterior to the larval stage.

SCHMIDT and others had rejected without valid reason the discovery made by BELLINI, viz., that the small elvers become males, and the medium-sized and big ones females. The writer has again verified Bellini's discovery, in his experiments.

The study of sex in eels was made on over 2 000 specimens, of which the gonads were mostly examined under the microscope, and has shown that in some places males are far most prevalent and in others females. Generally the former is the case far from the sea and the latter near the sea.

The author concludes from his research work that the sex of the eels is determined fairly late after fertilisation by environmental conditions, as with certain kinds of *Rana temporanea* and *R. esculenta*. He supposes, however, that the small elvers are already destined to become males, whereas the medium-sized and big ones may become males or females according to the place in which they grow up. These morphological observations refer to yellow eels. It may be taken as certain that silver eels having the SVRSKI organ are destined to produce spermatozoa, while those with plicated ovaries will produce ova.

Hence, the author's investigations on the whole confirm BELLINI's discovery, namely, that small elvers become small eels and large elvers large eels. In addition, they have established that the mean length of the elvers diminishes at the up-river migration, from October to April.

A practical result of these facts is that, for restocking purposes, elvers of the months of October, November and December, are best. It has been recommended to use also for this purpose young eels 6 to 12 inches

long. This plan would be a good one if specimens were available from places where females were much in excess, but how could they be obtained? At places where it is easy to find large numbers of eels of the above size (Fiumicino, Rocca d'Arno, etc.) the proportion of males is very high, so that it does not appear advisable to use these for restocking.

The Italian fishing regulations (1914) prohibit fishing out eels under 10 inches in length; a local by-law allows fishing and trading in young eels in the Provinces of Florence, Leghorn, Lucca, Massa Carrara and Pisa from December till February. The author remarks that when the number of elvers migrating up stream is unduly high compared with the quantity of water in which they can grow up, the resulting eels are doubtless numerous but they remain small. This is what happened after elvers were first put into Lake Bolsena. In Italy, at the places where females predominate and where, consequently, the prohibition of fishing for eels under 10 inches long could be an advantage, such small eels are never taken, but in places where males predominate (near the sea) the small eels exist in such swarms that there would be no harm done if the above regulation were suppressed, however many elvers are caught, there will always be left too many as compared with the quantity necessary to restock the waters in question.

1214 - **The Colouration of Salmon Fry and its Relation to the First Migration to the Sea.** — ROULT, I., in *Comptes Rendus des séances de l'Académie des Sciences*, Vol 168, No 19, pp 966-967 Paris, May 12, 1919

The author distinguishes 5 stages in the growth of salmon fry (*Salmo salar* L.) between hatching and the journey down to the sea (1), viz. (1) the vesicular stage, (2) the bare stage, (3) the scaly stage, (4) the pigment-transposition stage (in which the colour is modified to suit the arrangement of the migratory appendage) (5) the migratory stage. Pigmentation becomes progressively intensified during the first 3 stages, and the colour is due to a grey brown pigment. In the course of the 4th stage transposition begins, consisting partly in the disappearance of the brown pigment, save towards the dorsal region where the colour becomes uniform, and partly in the appearance of a new pigment of a fairly light bluish grey shade which forms spots on the sides and gives the fry a general colour much less dark than before. This is the migration livery, and the author observes that migration takes place *only after* the appearance of this livery and never before, whatever be the age of the fry. It would therefore, be right to assume that the migration down to the sea, as far as its principal immediate cause is concerned, might rise from a case of negative phototropism. The abundant brown pigment, which forms a screen to light radiation during the period of river life, would serve the fry as a means of resisting the action of the bright light in the streams where they then are. Besides, it is observed that the diminution of the brown pigment coincides with the search for deeper water, which takes the fry on first to the chief rivers and then to the sea, where it goes straight to the deepest and almost unlit zones.

(1) See R. May 1919, No 632 (Fd)

1215 - **Trout in the Tyrrhenian Sea** (1). — VINCIGUERRA, D., in *Rassegna di Pesca*, Year III, Series II, No. 1, p. 4. Rome, July, 1919.

In the stretch between Fiumicino and Ostia (Province of Rome) and to the north of Fiumicino, even at a certain distance from the mouth of the Tiber, trout of various sizes have been caught on several occasions, some 12 inches long and weighing about 14 oz. These were lake trout, fry of which have several times been thrown into Lake Bracciano, whose outlet, the Arrone, enters the sea about 7 miles north of Fiumicino. The descent to the sea must have taken place when they were fry, and the individuals of a certain size must have adapted themselves and passed part of their existence in the sea.

In any case, the presence of trout in the sea is not exceptional. In the northern seas of Europe there lives a kind of trout (called, in fact, sea trout) which returns up to fresh water only at the spawning season, like the salmon: it does not greatly differ from the lake trout and from those caught near Fiumicino.

The absence of this trout, as well as salmon, from the Mediterranean is generally attributed to the great saltiness of this sea. M. KOLOMBATOVICH, however, some years ago notified in the Adriatic near Spalato the presence of a trout, which he called *Trutta adriatica* and which apparently represents the sea trout of the Baltic and North Sea. The author also has called attention to the presence in the Tyrrhenian Sea of other trout, in Sardinia (Gulf of Terranova) and in Liguria near river mouths.

The author recalls that some years ago salmon were put into Lake Patria (near Naples), but this operation was not successful. Some time afterwards, however, there was caught in the Gulf of Naples a young salmon which very probably came from Lake Patria.

1216 - **Stocking of Waters by Means of Fry Previously Fed.** — *Bulletin Suisse de Pêche et de Pisciculture*, Year XX, Nos. 6-7, pp. 80-81. Neuchâtel, June-July, 1919.

The Swiss fishery establishments at present supply, besides very young fry, also fry which have previously been fed. These are young river or rainbow-trout which after their growth when hatched, have been artificially fed for 5 or 6 weeks. This new scheme has the special advantage of providing fry which need not be put in the water at the beginning of spring, i. e. when the weather is still cold. Besides, the already-fed fry are more hardy than the very young which still have their vesicle, and consequently stocking is less difficult. The young fish immediately become accustomed to the conditions of the water in which they have to live and by distributing a little artificial food, an almost unbelievable increase in size is brought about in a comparatively short time.

On the other hand, it must be stated that the young fish reared on meat scraps, etc., lose the liveliness and agility exhibited by those which are left to fend for themselves.

As a substitute for meat scraps which in these times cannot always be obtained in sufficient quantity, snails chopped as small as possible may be

(1) See *R. Oct.* 1918, No. 1142 (Ed.)

used for artificially rearing various species of trout, particularly rainbow trout. All kinds of snails, large and small, with or without shells, may be used. Cooking is not necessary; the snails must be chopped up and given fresh to the trout.

1217 - **Fresh-Water Fish-Culture in France.** — LOIR A and LEGANGNEUX, H., in *Revue générale des Sciences*, Year 30, No 11, pp 350-352. Paris, June 15, 1919.

The following information is taken from the "Comptes Rendus du Congrès de l'Étang" (which met at Paris in March 1918) published by Messrs. ROULLÉ, professor at the National Museum of Natural History, and E. POHER, Chief Inspector to the Orleans Railway Company.

France imports from abroad, in particular from England, Germany, Holland, Belgium, Switzerland and Italy, fresh-water fish of considerable value. In 1911 the imports were of the value of 6 897 250 francs, against exports valued at 328 340 francs.

Holland sends to France trout, salmon, perch, gudgeon and pike; Germany trout and pike, as well as crayfish mostly of Russian origin; Canada frozen salmon; Great Britain and Switzerland trout and salmon; and Italy and Belgium eels.

The Administration of Direct Contributions estimates at 176 040 hectares (about 440 100 acres) the area of the lakes, marshes, ponds, watering places and un-navigable canals in France which could be used for fish culture. M. CARDOT, Fishery Chief at the Ministry of Agriculture, states that the ponds actually used for fish culture do not exceed 110 000 hectares (about 275 000 acres) in area.

The greatest number of ponds is to be found in the Ain and Sologne districts. In the Lower Seine Department, statistics indicate 559 ponds with an area of 349 hectares (about 872 acres), of 30 896 francs rental value and 1 666 090 francs purchase value.

Trout, to which French fish breeders of recent years have devoted most attention, require highly aerated waters, containing at least 6 cc. of oxygen dissolved in the water. Furthermore, they are great flesh-eaters and the profit from rearing them diminishes in proportion to the relative requirements in this food. Also, according to M. ROULLÉ, carp should be chosen exclusively for pond rearing at low and medium altitudes; they live in such places without difficulty, increase rapidly, are not exacting as to temperature and feed on either vegetable or animal flesh food. They need only a sufficiency of food.

The common carp which, at the end of the first summer, weighs 8 grammes reaches 30 gm. at the end of a year, and after the third summer 400 gm., while at the fifth summer it weighs 2.5 kg. and at the eighth 9 kg.

Selected carp, especially the varieties called "leather" carp which have a much finer flesh, show a still more rapid growth.

The most usual selling carp is the 3 or 4 year old, weighing about 750 gm. It is for this reason that ponds are fished every three years.

Supplementary feeding must be rational. What is necessary and no

more, should be given, and it is well to know roughly the quantity of fish to be fed. The calculation is very easily made.

Among 1st-summer carp the death rate is enormous, being estimated at 80 %. During the 2nd summer, the fish being more robust, the death rate falls to 12 %, and finally in the 3rd summer it is not over 7 %.

Hence, 100 000 ova give: —

15 000-20 000 young carp of the 1st summer falling to :

10 000-12 000 in the course of the 2nd summer, and to :

8 000-9 000 in the course of the 3rd summer.

Carp of the 1st summer require a diet rich in animal products — equal parts of meat or blood mixed with vegetable food (lupins, barley, maize). For 2nd-year carp, the animal matter is diminished and not more than $\frac{1}{4}$ or $\frac{1}{5}$ of meat is put in the mixture. Finally, for 3rd year carp, only vegetable matter is fed. In addition, the fish needs mineral matter, which may be supplied by adding limy substances (chalk, bone dust, etc.) to its food, in order to form its skeleton and scales.

Carp become accustomed very quickly to come for their food at a fixed hour and always at the same place. So if the food is put in small containers always at the same spot, the feeding may be checked and there will be no loss of food.

Lupin seed seems to give the best return as a vegetable food, 3 kg. of them producing in one summer 1 kg. of fish flesh. Maize gives too fat a flesh.

Mr. VALLOIS, fish breeder at Fismes (Marne), who has studied very methodically the feeding of fish, has calculated the ration at the rate of 8 to 9 per cent. of nitrogenous matter at a very low net cost. One of his typical mixtures is 6 $\frac{1}{2}$ lb. maize meal, 6 $\frac{1}{2}$ lb. linseed meal, 2 $\frac{1}{5}$ lb. soya meal, 2 $\frac{1}{5}$ lb. meat meal and about 5 gallons water.

Artificial feeding should be practised from June to September. In order to decide when it should be started or stopped the transparency of the water should be examined. When carp are hungry they search frantically among the mud, thereby fouling the water. On the other hand, when their appetite is satisfied they no longer search in the mud, and the water becomes clear, so that it is useless to continue the feeding.

During winter carp do not assimilate food ; they eat nothing or very little, and move about very little. Hence, from October to April, the fish may be collected together within a small space ; for example 50 kg. of carp can live without inconvenience in one cubic metre of water. This period may taken advantage of in order to empty the pond and treat the bottom with a dressing and liming.

Fish from ponds are often found fault with for having a muddy taste. This taste does not come from the mud at all, but from small algae (*Oscillaria*) which are very numerous in muddy water. These algae are very easily destroyed by liming, hence the advantage in carefully treating the bottom of the pond.

In small ponds the fishing is mostly done during the week of Lent, a time when the best sale is done on account of the demand. In Sologne, it is done from September 29 to March 25, in Bresse from October 15 to March

31, in the Dombes from August 15 to the coldest part of the year and then from the end of winter to March 15. In the Somme, the mill-ponds are not drained completely and fishing is carried on at all seasons. The fish are sold in Paris, Rheims, Epernay and St. Quentin.

Transport of the fish plays an important part in their sale. The provider has the greatest interest to bring his fish to market alive; when dead, fresh-water fish lose 30 to 40 per cent. in value.

For small packages of not more than 50 to 60 lb. or for short-distance transport, the fish may be packed in a wicker basket, each separately with grass or moist straw between. For longer distances, wooden or metal containers are used, and for a half-day's journey there should be allowed —

1 gallon water for 2 lb. tench or carp of 2 to 3 years;

2 gallons water for 2 lb. carp of 1 year;

2 to 4 gallons water for 2 lb. trout, perch or pike.

In summer the water should be kept cool with ice without letting it go below 4°C.; also the ice should never be put directly into the water but should be let melt gradually over the surface of the liquid. Water and packing alone account for $\frac{1}{4}$ of the total weight to be sent, and now railway transport rates are very high.

The Orleans Co. has hired out 2 wagons to be managed by the French society for the extension of fish culture. Such wagons were very much used in Germany.

Tank-boats are another means of transport. In these the fish are in their usual surroundings and consequently can live there a long time; besides, this form of transport is not expensive. Paris is served by 8 of these boats.

1218 — **The Fresh-Water *Eleotris* of Madagascar.** — PELLEGRIN, J., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXIX, No. 2, pp. 99-101. Paris, July 15, 1919.

The *Eleotris* are carnivorous fish, mostly of small size, of the Gobiidae family. The species of this genus are very numerous, they are found on almost all the coasts of tropical or temperate regions, a certain number penetrate up rivers and some even confine themselves entirely to fresh water. Thus, in Africa fifteen species are known to be more or less completely adapted to a fresh-water life.

The genus *Eleotris* appears to be one of the richest in species in the fresh water of Madagascar; as many as 7 of these have been found.

The facts observed by the author agree with what he had already stated in 1914 as to the characteristics of the ichthyological fauna of the great African island (1), namely, that the entirely, fresh-water species are very rare (some Cichlidae, Siluridae, Cyprinodontidae), and that on the other hand the best represented families are those that are both marine and fresh-water (Gobiidae [*Eleotris*], Atherinidae, Mugilidae, Anguillidae). This statement is not without practical importance, as it is known that these latter families,

(1) J. PELLEGRINI "Sur les Athérinides des eaux douces de Madagascar" in *Comptes rendus de l'Académie des Sciences*, Vol. CLXIII, p. 432. Paris, 1914. (Author's note.)

which are quite common on the coasts or in the rivers of France, include a good number of species interesting from the food-supply point of view.

1219 — **Fish Diseases: *Saprolegnia* attacking the Gills of Perch; Tumours of *Carassius auratus*.** — SUPINO, F., in *R. Istituto lombardo di Scienze e Lettere, Rendiconti*, Series II, Vol. LII, No. V-VIII, pp. 239-243. Milan, 1919

In perch weighing 1 $\frac{3}{4}$ to about 7 oz. each, which showed no outward sign of disease, the author has noted the existence of the fungoid parasite *Saprolegnia* on the gills. This fungus often attacks fish which are not in a good state of health, especially in parts where there is some injury, and brings about saprolegniaceous dermatomycosis, which may pass from the skin to the gills. On the other hand, in the case cited by the author, the skin was perfectly healthy and only the gills were affected by the *Saprolegnia*. This form of the disease naturally is much more serious than the cutaneous one, and quickly leads to the death of the animal. It shows itself in asphyxia, that is, when it is already too late to be able to treat it with the certainty of success.

The cutaneous form of the disease is treated principally with: 10 % solution of sodium chloride, corrosive sublimate 1 in 1000, 1 % permanganate of potash, oxygenated water, etc; a pad of cotton wool soaked in the solution is passed over the affected part. For the gill form the author advises immersing the fish in a basin containing 1 part of oxygenated water to 6 parts water for a few minutes, 5 at most, or else, when large quantities are required, immersion for half an hour in a 1 in 100 000 solution of permanganate of potash.

The author has noticed in a large specimen of *Carassius auratus* the formation of two large symmetrical tumours on the operculum, due to an epithelial neoplasia. He is continuing the study of this uncommon pathological form.

1220 — **The Wild Coat of the Rabbit.** — FRATEUR, J. L. (University of Louvain), in *Comptes Rendus des Séances de la Société de Biologie* (Meeting of the Belgian Biological Society), Vol. LXXII, No. 23, pp. 941-943. Paris, July 19, 1919

VARIOUS
ANIMALS

Two groups of coats in the rabbit are characterised by discolouration in certain parts of the body: the *agouti* coat, of which the type is the black or common wild agouti, and the *coloured and auburn* coat, of which the type is the black and auburn. According to the ideas prevalent in genetics, the agouti colour in the rabbit is due to a Mendelian factor commonly designated as G. It results from researches carried out at the Zootechnic Institute of Louvain that the agouti factor is really a group of factors, of which some members have been able to become evident. In crosses of homozygous agouti rabbits with coloured and auburn-coloured rabbits, the first generation of hybrids (F_1) is composed entirely of agoutis. The cross $F_1 \times F_1$ gives the dissociation 3 : 1. Hence the *coloured and auburn* is recessive and the *wild or black agouti* is a black and auburn possessing in addition a factor producing the characteristics of the wild coating not included in the auburn coat. The latter, on the other hand, in the presence of uniform coloured coats, behaves in all its characteristics as a simple dominant. All

Rakes.—Two types are in demand: light and heavy, as well as a small number of very heavy specimens. Before the war the heavy makes came from France (300 to 400 a year) and the light from the United States (about 800). Up till now, no factory appears to have taken up the construction of rakes.

Tedders.—Before the war, annual imports came to: 800 fork tedders—200 drum tedders—150 swath turners. The first were almost all brought from America, with some from France and Germany: the second from Germany, the third from France, with a few from England. During the war, as prices had risen, no more than 400 were imported per annum. The drum and swath turning types are at present being made in Italy in two different works.

"Ranghinatori" (Continuous side-delivery rakes).—Formerly over 500 of these machines were put into use each year; at present not more than a hundred are used.

Reaping machines.—The American Trust furnished Italy with about 1200 reaping-and-binding machines a year. Except for the right and left type and the length of the cutting mechanism, there may be said to be only one type. Common reapers are still in some demand (200 to 300 a year) but they tend to give place to the binders.

Threshing machines. Before the war, about a million of these machines were in use in Italy. It is said that even before 1914 about 500 were being made there, but it is doubtful if the country by itself can furnish the number of these machines necessary.

Small steam engines. The figures are the same as in the case of threshing machines.

Mechanical fodder presses. About 500 are required per year. Italy can supply them all, threshing-machine factories usually make them.

Simple mechanical hullers.—A few hundreds are sold each year, mostly of the country's own make. Maize threshers and hullers are in still lower demand, home production can entirely meet the demand.

Winnowing machines, small maize hullers, small fodder presses.—Less than a thousand of each of these machines are needed, mostly made of wood and almost all of home manufacture.

Wheat sorters.—Of all-Italian make and very good.

Large seed-cleaning plants.—These are managed in Italy by factories making a speciality of this kind of construction.

Grape presses.—In 1914, there were in Italy a hundred works making these presses; the annual demand exceeded 4000. The most common type is the MABILLI, of which several hundred were imported from Germany. Large presses, such as hydraulic, ones were imported, but some are also made in the country.

Grape crushers.—The demand is for about a thousand. At least fifteen models are made and imported.

Oil presses. These are built by factories which supply grape presses.

Olive mills.—The demand is limited; home production is sufficient for the demand.

Hay and straw choppers. - Before the war, about 4000 were imported yearly from Germany (and very few from Switzerland), home production having become impossible owing to the low manufacturing cost in Germany (about 50 centimes per kilogramme, goods delivered duty free in Italy). Now these machines are manufactured in three Italian factories. The types in demand are 3 in number: with intake about 20 cm wide and without a feed chain, with intake about 30 cm. wide and with a feed chain and treadle, large size driven by motor (3 HP).

Cake crushers and root choppers - About a thousand are in demand. They were imported from England. An Italian factory has begun to make them

Small mills for medium sized farms. - From 200 to 300 a year; imported from England. The factory that has begun making root choppers has taken up their manufacture.

Crescent pumps - Of *sheeron* about 1400 are in demand, of foreign make *of cast iron* about 500, made in the country

Boilers for cooking feeds are in great demand.

There is likewise a strong request for *rollers* for levelling ground turned up by artillery fire in the liberated regions.

In conclusion it can be said that Italy is starting to manufacture herself almost all the machines needed in agriculture

1222 - **Trials of Mechanical Cultivating Machines in France.** I SAGNIER, HENRY I, 1 Semaine de Motoculture de Printemps, in *Journal d'Agriculture Pratique*, Year LXXXII, New Series, Vol XXXII, No 11, pp 214-218, 4 figs Paris, April 17, 1919 - II La Semaine de Motoculture de Printemps, *Bulletin de la Chambre syndicale de la Motoculture*, No 4, 56 pp, 35 phot + 1 plan Paris, April, 1919. - III CLARON, CH, Les Journées de Motoculture des Bouches du Rhône, in *Le Progres agricole et viticole*, Year XXXVI, Vol LXXI, No 23, pp 534-539, 1 fig Montpellier, June 8, 1919 - IV GREILHAMMER, R, Les tracteurs aux essais de Strasbourg, in *Journal d'Agriculture pratique*, Year LXXXIII, New Series, Vol XXXII, No 22, pp 451-454, 2 figs Paris, July 3, 1919.

I - The demonstrations of mechanical cultivation organised by the "Chambre Syndicale de la Motoculture" under the title "Semaine de Motoculture de Printemps" (March 30-April 6, 1919) constituted the most important show held up till now in France. Thirty makers or agents of machines took part in it, for the first time the number of machines of French make was higher than that of American or English makes. This fact indicates the energetic attempts to develop in France an industry which, scarcely in existence before the war, has sprung up steadily during these last years in spite of daily increasing difficulties and of which the progress can no longer be arrested.

The organisation left nothing to be desired. The extensive fields of the Jonction farm, on a rolling plateau stretching above Saint-Germain-en-Laye, formed a suitable ground for the long strips, in open land, in excellent condition for ploughing. Visitors were numerous, the eagerness of farmers to examine the machines and to discuss their qualities showed the interest felt everywhere in the new cultural method.

Power-farming implements come under several categories: — direct tractors, cable tractors, motor ploughs and motor cultivators proper. Machines of all these types were working at St. Germain-en-Laye, some already well known and others appearing for the first time.

Most of the direct tractors having the chassis borne on wheels, of French make, had left the work-shops only shortly before; some of them have already been described, e. g. the S. C. E. M. I. A. tractor of 25 H.P., weighing 2 650 kilogrammes, which did very regular work with Deere three-furrow ploughs, and the tractors of the *Agricultural* company which was one of the first going.



Fig. 1. — Road, farm, and colonial tractor, *Landrin* system.

The *Atlas* is derived from the Mesmay tractor, it is 15 H.P., weighs 1 400 kg. and is a light, strongly made machine.

The road, farm and colonial tractor, on the *Landrin* system (Fig. 1) is made by A. Goutz & Co. It is a 24 H.P. lorry weighing 2 200 kg. and suited to road transport. By the attachment of wheels with strakes, it can be coupled to a three-furrow plough and other farm implements.

The *Auror* tractor (Fig. 2), shown by the Neuerburg et fils works, Paris, is built by the Société Gnome et Rhône. This is a light machine of 1 400 kg., 16-20 H.P., with driving wheels having removable rims, the construction of which appear to be very strong.

The *Feuillette* farm tractor is remarkable especially for its system

of removable rocking strakes applied to the wheels so as to secure a good grip on the ground when ploughing.

The well-known *American Tractor* is now built in France. The model taking part in the trials was of 40 H.P., weighing 3 000 kg.

Among foreign-made machines, the *Case* has already been widely tried; the model at the trials was of 18 H.P., weighing 2 100 kg. The same remark applies also to the *Titan* tractor (10-20 H.P., 2 950 kg.), the *Avery* tractor (16 H.P., 2 700 kg.), the *Moline* tractor (18 H.P., 2 000 kg.), the *Rip* tractor (9-16 H.P., 1 800 kg.), the *National* tractor of the *Butterosi Syndicate* (9-16 H.P., 1 700 kg.). These machines have been described in our pages, but it should be added that the *Rip* tractor is combined with

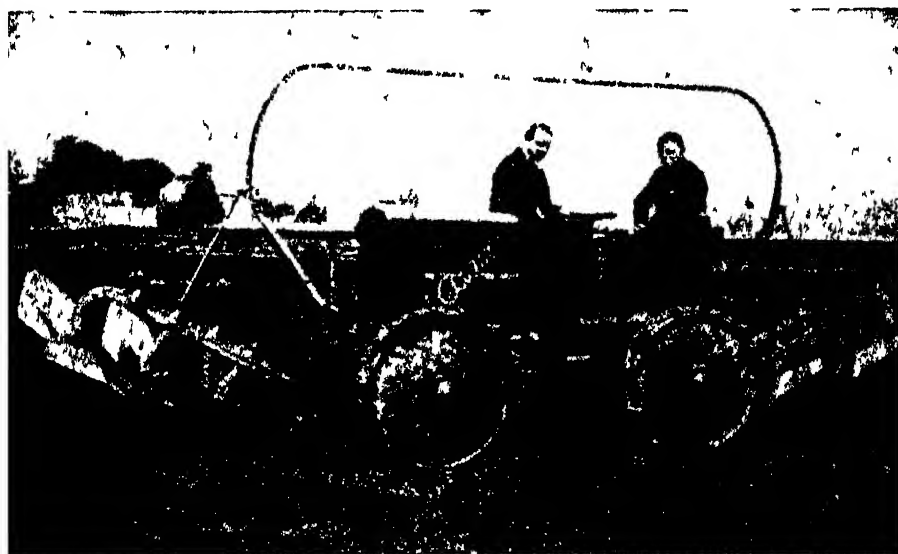


Fig 2 -- Auror tractor

the Rock Island two-furrow plough, a system which enables the headlands to be greatly reduced.

The American *Fordson* tractor, from the FORD works, well known for motor-car building is a light machine (12-22 H.P., 1 600 kg.) which is very attractive for its elegance and strength. The engine has four cylinders and runs on paraffin, like a number of others. The working parts are hermetically enclosed. Twenty five Fordson tractors have been purchased by the American Relief Committee (Mrs. Dike and Miss Morgan) for the Aisne district.

The *Austin* tractor (20-25 H.P., 2 300 kg.) of English make, drawing an Oliver plough, was exhibited by the PILTER firm, and was notable for very even work on one of the few difficult parts of the trial grounds. It

is announced that the *PILTER* firm is taking up the construction of these tractors in France

Caterpillar tractors are already familiar: an endless chain with strong links envelops the wheels and gives the machine a powerful grip on the soil while distributing the weight of the chassis over all the contact surface. The *Lefebvre* (30-40 H P 5 000 kg) is a well known type of these machines

Another machine of this class, and quite new, is the *Renault* tractor (30-35 H P., 3 500 kg.) built by the firm famous for its light tanks. This model attracted great attention through its flexibility in running and the even work done by it with a three-furrow plough

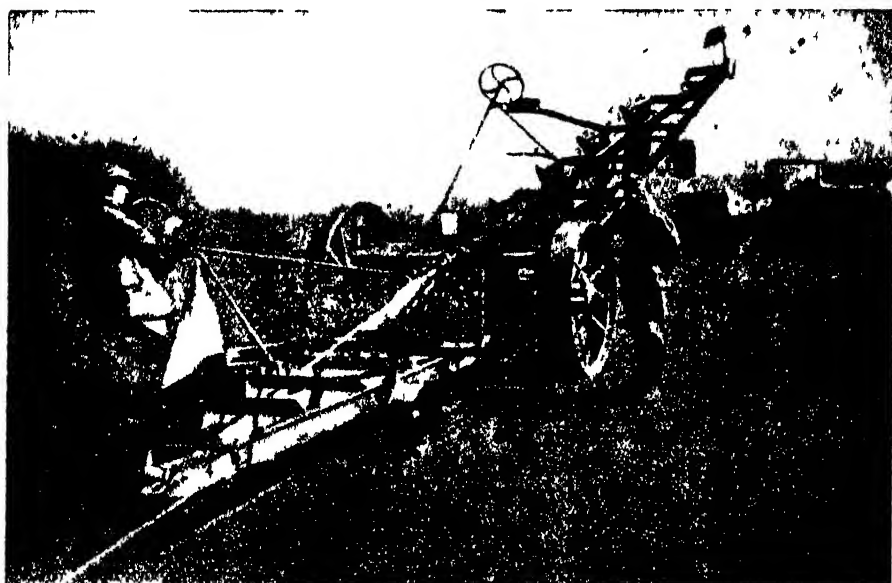


Fig 3 — Ploughing with the *De Dion Bouton* windlass

Two American caterpillar tractors are already known the *Cleveland* (12 H P, 1 950 kg) and the *Nevership* (12-20 H P., 3 100 kg.) of the A. W. PLOWMAN Company

The forms of cable tractors are various. The *Holtz* towing tractor (30 H.P., 2 150 kg.) is one of the foremost in mechanical cultivation; serving for deep ploughing with a double two-way plough, it may be used as a direct tractor for medium ploughing and other work.

The *Doisy* windlass-tractor (25 H P, 5 000 kg) is likewise well known. It executes heavy ploughing by windlass and may be used as a direct tractor.

The *De Dion Bouton* windlass (50 H.P.) for ploughing is one of the most powerful machines suitable for large scale cultivation (Fig. 3.) Between

two windlass engines of the above power, a strong cable pulls a six furrow balance plough working to a depth of 25-30 centimetres. The windlass for ploughing, as in steam cultivation, may be adapted to all other cultivating implements.

The *C. E. M.* electrical windlass (40-50 H.P.) of the Electro-Mécanique Company works on the same principle.

On a much smaller scale the *Agro* fore-carriage tractor (6-8 H.P., 700 kg.), drawing a double two-way plough or a double two-furrow plough, advances by winding up a cable the end of which is anchored at the end of the furrows.

Among motor ploughs, the *Tourand-Latil* plough (30 H.P., 3 000 kg.) is one that has attracted attention for a long time. It has been gradually modified and has become a more and more valued machine. It is composed of two parts closely united but capable of being separated: the tractor



Fig. 4. — Chief type of S. O. M. U. A. motor cultivator.

and the five-furrow plough. Apart from the plough, the tractor may be attached to all other cultivating or harvesting machines. All parts of the apparatus are very substantial.

The *Delahaye* motor rocker plough (32 H.P., 4 000 kg.), on view for the first time, was one of the greatest attractions at Saint-Germain-en-Laye. A powerful chassis on three strong wheels arranged in a triangle carries the engine in the centre, and at each end has a multi-furrow plough which can turn over as in a balance plough. The machine ploughs both ways, on the level to a depth of 25-30 centimetres, and the work appears excellent.

With motor cultivators and pulverisers, the latest series of mechanical

cultivating implements is reached. These machines, which have been studied for some ten years, are destined to take the place of ploughs.

The *S. O. M. U. A.* motor cultivator is represented by two types. The chief type (35 H.P., 2 000 kg.) (Fig. 4) consists of a tractor and a drum inside which a horizontal shaft carries a series of claws or cutters made to rotate fast and so dig the soil. Separated from this drum, the tractor can be attached to a multi-furrow plough or to any other implement. The other type (6 H.P., 300 kg.) is a quite small model for market garden work; a lever at the rear enables the workman to steer the machine.

The *Xavier Charmes pulveriser* (16-20 H.P., 2 000 kg.) has undergone many changes since the first trials in which it took part. It is now a machine which runs smoothly and, as its name indicates, brings about as perfect a pulverising of the soil as possible.

II. — No. 4 of the *Bulletin de la Chambre syndicale de la Motoculture* is wholly devoted to the Spring Motor-Cultivation Week. After a reproduction in full of the speeches of Capt JULIEN, President of the Chambre Syndicale, and of M. BORET, Minister of Agriculture and Food Supplies, and of the list of 31 machines that took part in the trials, a detailed description is given, with very good photographs, of 16 exhibits of French make. Lastly, the Bulletin quotes the Law of January 6, 1919 for the intensification of agricultural production during and after the war, the Decree of April 25, 1919 constituting and regulating the working of the departmental and regional Offices of Agriculture, the Circular of the Minister of Agriculture to the Prefects, the Law of November 27, 1918 (CHAUVEAU Law) for the purpose of facilitating the restoration of rural property, and the regulation for the Autumn Motor-Cultivation Week, 1919, etc.

III. — From May 16 to 20, 1919, there were held at the Grand-St.-Jean estate, in the commune of Aix-en-Provence, interesting practical demonstrations of mechanical cultivation organised by the Comité d'Encouragement à la Motoculture des Bouches-du-Rhône.

The land on the estate had for the most part been uncultivated for several years. Thus the task of the tractors was a particularly rough one, and the work done by them was all the more convincing.

The tractors were of two makes: French and American, of which the former were in the majority.

Tractors for vineyards were tested on the Beaupré estate, 3 kilometres from the station of Lignanes-Rognes.

The following were the French makes of tractors: — *S. C. E. M. I. A.* (Société de Construction et d'Entretien de Matériel industriel et agricole). of 15-24 H.P., 2 cylinder (the Company exploits in France the English Saunderson patent) drawing a rigid three-furrow *John Deere* plough 90 cm. wide — *Tourand-Latil* of the Société Blum et Cie. — *Renault*, caterpillar tractor — *Doisy* — *Fultz* — *Xavier-Charmes* and *S. O. M. U. A.*, both having "cutters" for pulverising the soil.

The American tractors were: *Mogul* and *Titan*, both 10-20 H.P., 2 cylinder engines — *McCormick* — *Case* 10-18 drawing a *Grand Détour*

two-furrow plough — *Avery* 12-25 of the Pilter firm — *Happy Farmer* — *Neverslip* and *Cleveland*, both chain-track types.

Vineyard tractors. — 1) French: *Chapron*, *Sud-Automobile* and *S. O. M. U. A.* (models A and C) — 2) American: *Cleveland* and *Avery* (5-10 H. P.) (1).

IV. — The General Commissariat of the Republic and the Director of Agriculture for Alsace and Lorraine organised public demonstrations in mechanical tillage which took place on June 5-9 in the Neuhoof Polygon, near Strasburg.

A large number of makers responded to the invitation of the Director of Agriculture, thus giving special amplitude to this first agricultural show held in Alsace.

Many Alsatian farmers attended the trials, and also many Lorraine farmers visited Strasburg to see the machines at work, because although the sub-division of property in Alsace keeps mechanical cultivation from becoming widespread, on the other hand, in Lorraine, the demand for tractors is considerable, conditions of cultivation — larger estates, land difficult to work — being favourable to the development of these machines there.

Twenty-three exhibits, comprising 32 machines, were assembled in the Neuhoof polygon. The machines according to nationality of origin were divided thus: French 11 — American 18 — English 1 — Swiss 1 — Swedish 1 — Total 32.

Two foreign machines, however, the *Gray* (American) and the *Austin* (English) are about to be manufactured soon by works in France.

The machines shown were classified as follows:—

- 1) Windlass machine:— French: 1 *Fultz* 40 H.P. towing tractor.
- 2) Tractors with 2 driving wheels:— French: 1 *S. C. E. M. I. A.* 25 H.P. tractor — American: 2 *Case* 18 H.P. and 27 H.P. tractors — 1 *Rip* 16 H.P. tractor — 1 *Fordson* 22 H.P. tractor — 1 *Globe* 18 H.P. tractor — 1 *Happy Farmer* 18 H.P. tractor — 1 *Le Gaulois* 25 H.P. tractor (Lacour and Fabre) — 2 *Titan* 20 H.P. tractors (C. I. M. A.) — 1 *McCormick* 20 H.P. tractor (Wallut) — 1 *National* 22 H.P. tractor (Butterosi Syndicate) — 1 *Parrett* 24 H.P. tractor (La Traction agricole) — English: 1 *Austin* 25 H.P. tractor (Th. Pilter).

- 3) Tractors with one driving wheel:— American: 1 *Gray* 40 H.P. tractor (American Tractor) — 1 *Taureau* 24 H.P. tractor (Agricultural).

- 4) Tractors with 4 driving wheels:— French: 2 *Auror* 16 H.P. tractors (S. Neuerburg & Fil.).

- 5) Fore carriage tractors — American: 1 *Moline Universal* 18 H.P. tractor — Swiss: 1 *Griffon* 16 H.P. tractor.

- 6) Motor ploughs:— French: 1 *Tourand-Latit* 35 H.P. motor plough — Swedish: 1 *Avance* 18 H.P. motor plough (Wallut).

- 7) Caterpillar tractors. — French: 1 *Renault* 35 H.P. —

(1) For vineyard tractors, see "Montpellier Trials", R., June, 1919, No. 768. (Ed.)

2 *Peugeot* 38 H.P. — American : 2 *Neverslip* 20 and 30 H.P. tank tractors (Pidwell) — 1 *Cleveland* 20 H.P. (Allied Machinery Co.).

8) Motor cultivators. — French : 1 S. O. M. U. A., 35 H.P. — 1 S. O. M. U. A., 5 H.P.

Many of these machines have already been described. Some new ones deserve more detailed description.

The works of S. NEUERBURG & SONS (3, rue la Boétie, Paris), showed 2 *Auror* tractors, one attached to a Deere plough for ploughing in ridges, the other fitted with a new arrangement for ploughing on the flat. These tractors, with 4 driving and steering wheels, are remarkable for their lightness. With a *Ballot* 4 cylinder 16, H.P. engine, at 1 200 r. p. m. (stroke 140, bore 80 mm), they weigh only 1 300 kg. The 4 driving wheels are considered to give greater grip in spite of this low weight. The *Auror* has symmetrical transmission round the transverse axis and can go both ways, reversing at the end of the furrow without turning round.

At each end of the machine is a 2 furrow plough (Fig. 2) suspended by a tension rod with a mobile lifting arm on a horizontal axis. A handle within reach of the driver moves a small winch on which a thin cable winds, attached to the lifting arm.

The cable acts simultaneously and inversely on the lifting arms of the 2 ploughs, joined by an iron bar passing above the driver. Thus one of the ploughs balances the other and when one is raised the other is lowered and is ready for work on the return journey. This simple light arrangement enables the machine to work on the flat without turning and with small headlands, the changing-over at the end of the furrow occupying less than one minute.

The tractor wheels are fitted with traked rims made of 3 pieces fixed by simple collars to the wheel, so that they can be removed for road travel in a very short time. The gripping rim may be substituted by a rubber tire fixed in the same way for road work.

The *Auror* tractor, built by the Société Gône et Rhône is sold with a plough for ploughing without ridges for 1 500 francs.

The *Griffon* tractor, made by the Société de fabrication de chauffage central de Berne and shown by Nathan Bloch & Sons (50, rue des Marais, Paris) made its first appearance in France at Strasbourg.

This is a fore-carriage tractor with 2 driving and steering wheels and 2 rear rolling wheels. The tillage implements are attached under the motor axle by a long chain. The engine is 16 to 20 H.P., 4 cylinder.

By means of a reversing coupling, without gear changing or toothed gearing the tractor can go forwards or backwards at will. Reversing is done without shock, even if the controls are jerked roughly into place. This arrangement allows of the machine working with 1 or 2 two-way ploughs. Hence it does not need to turn at the end of the furrow. There is no differential in the machine. Each driving wheel may be disengaged and run loose on the axle. Turning is accomplished by disengaging the wheel on the inner radius of the turn. The wheels are fitted with a very curious system of jointed segments furnished with strakes which can be

quickly put in operation for ploughing or withdrawn for road work. Six segments are arranged round the rim of the wheel, each of which segments can pivot round one of its ends and the other end can be clamped at will on to the periphery or the hub, according as the strakes are to be put in action or withdrawn. Two holes are bored on the rim for clamping, which allow, by using one or the other, of making the strakes project more or less as required for the soil. The present price of the *Griffon* tractor is 16 000 francs.

The great French motor car and cycle firm, Cie. Peugeot, showed for the first time its type T caterpillar tractors.

The *Peugeot* tractor has a 4 cylinder, 38 H P. engine running at 1 200 revs. (bore 100 mm and stroke 150 mm.). The engine is the same as that on the Peugeot lorries used during the war.

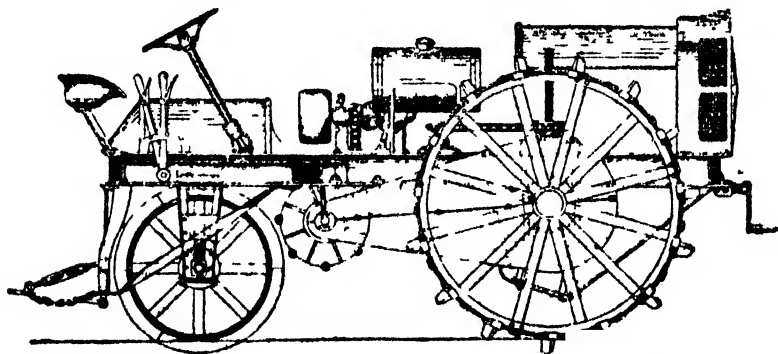
The *Austin* tractor shown by the Th. Pelter Co. was much remarked upon, and made its first appearance in France in the trials held at Saint-Germain-en-Laye.

This machine, with its 25 H.P. engine, is of the shield-frame type, all the parts being enclosed within a shield, which itself forms the chassis of the machine, being supported in front on the axle and behind on the driving wheels. The tractor is of small dimensions, very easily handled, and weighs 1 500 kg. It did good work at Strasburg on stiff land. The present price is 12 500 francs.

Messrs R. Wallut & Co. showed the *Arvance* motor plough, of Swedish make, with semi-Diesel engine of 18 H P. which runs on heavy oil or paraffin. The three plough bodies can be removed independently of each other. Although this machine, on account of its power, is fairly heavy and bulky, it shows a first interesting attempt to make use of economical fuels, the employment of which in agriculture will gradually come to displace the too expensive petrol as these engines become more developed and perfected.

1223 - **The Baroncelli Tractor. Model B 2, 1919.** — POGGI T., in *Il Coltivatore*, Year LXV, No. 23, pp 473-475. 1 fig Casale Monferrato, August 20, 1919.

The Baroncelli tractor, built in series by the "Società generale in-



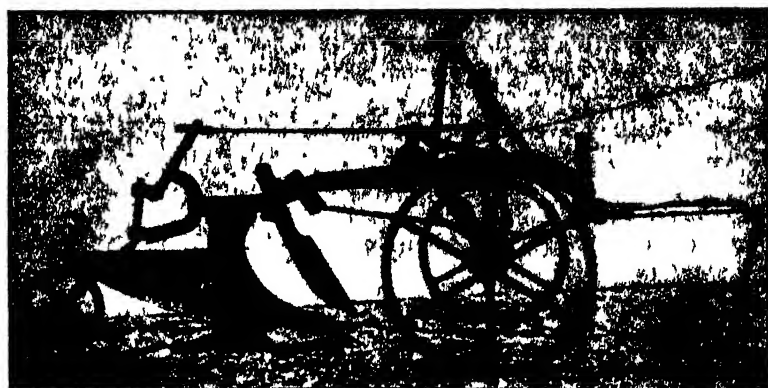
BARONCELLI tractor, B 2, 1919.

dustriale" (19, Corso d'Italia, Rome) has the following characteristics:— total weight 2700 kg. — maximum height 1.80 metre — outside gauge of driving wheels 1.60 metre — first speed 3 kilometres per hour; second speed 6 km per hour — diameter of belt pulley 300 millimetres — width of belt of driving pulley 180 mm. — revolutions of driving pulley 800. The machine is well made: ball bearings; strong springs; engine 40 HP. 4 cycle, 4 vertical cylinders, running on petrol or paraffin; pump cooling; oiling by pump, wheels with strakes removable for road work; one wheel can run in the furrow without the chassis being tilted, thus ensuring easy and sure steering; maximum grip on soil, easy turning even at extreme lock

1224 - **The Longhini Self-Lifting Plough.** — I. *Giornale di Agricoltura della Domenica*, Year XXIX, No 32, p 229, 4 figs. Piacenza, Aug 10, 1919 - II Communication from Signor Longhini to the International Institute of Agriculture.

I. - - The inventor, Signor LONGHINI, set out to obtain a plough that would have great stability in the ground, even at tractor speed, and would not require a man continually in attendance.

The single Longhini plough consists essentially of a strong frame supported on 3 wheels and carrying a large plough body. The setting is controlled by means of small wheels and screws, so that there are neither hand levers nor toothed sectors. Attachment is made between the tractor hook and the part of the beam situated a little in front of the coulter. The self-lifting arrangement is simple and very efficient



LONGHINI Self-Lifting Plough.

This plough requires a powerful tractor to draw it. The inventor adapted it specially to the Fiat (1). Its mean weight is 5 quintals and mean effort per square decimetre of furrow slice 67.3 kg. The first models built are furnished with H 16 Italia bodies for a depth up to 45 cm, but any other type of body can be used.

(1) See R. Nov., 1918, No 1869. (Ed)

The Longhini plough can be converted into a double-furrow one by attaching smaller bodies, so that a tractor may be used giving an average drawbar pull of 1 300-1 500 kg. This new implement can be built rapidly in large series.

II. — Signor LONGHINI (technical head of the Italian Federation of Agricultural Consortia) furnished the International Institute of Agriculture with the following details on the construction of his plough: The single self-lifting plough is composed of 4 different parts: — 1) Frame. 2) Self-lifting and regulating arrangement. 3) Plough body. 4) Attachment system.

1) The *frame* is made of 2 iron laths, first rivetted together at the rear part so as to form a beam supporting the plough body, coulter and share, then diverging and lastly parallel at the fore part, where they are connected by a rigid cross piece.

On this frame there are fixed — the supports of the axles of the fore carriage — the depth regulator — the spring attachments — a second cross piece, vertical and pierced by holes for regulating the draught.

2) The *self-lifting* effect is obtained by rotating through 180° a crank centred on the left wheel, jointed with a connecting rod fixed to the frame and controlled by means of a screw. This crank rotation causes the left axle to turn, which transmits the movement to the right one and to the back wheel by means of levers fixed on the axles and connected by a screwrod.

The automatic 180° rotation of the crank is produced by the forward movement of the left wheel, in which a gear is fixed which by an arrangement of levers on the crank can raise or lower the plough at the driver's will. This mechanism is controlled by lightly pulling a cord.

Setting of the plough is done by 2 screws — one alters the height of the connecting rod attachment, which lowers the frame more or less according to the depth desired; the other screw, serving to connect the axle levers, alters horizontally the plane of the frame.

3) The *plough body* may be of various shapes according to the nature of the soil. It is fixed by 2 bolts to the beam, which may be straight or curved.

4) For the *hake*, an drawing rod slanting downwards to the left in relation to the frame is fixed to the beam, so as to obtain a variable attachment, a) to various heights to suit the drawbar hooks of the tractors, b) more or less sideways so that it may be possible to bring the tractors line of traction near the line of resistance.

The plough is fixed close to the tractor, to reduce to a minimum the turning radius of the machine.

1225 - **Review of Patents.** — Sources: CANADA, UNITED STATES, NEW ZEALAND, NETHERLANDS, UNITED KINGDOM, SWITZERLAND, See R. Jan., 1919, No. 105. — FRANCE, See R. Feb., 1919, No. 247 — BRITISH INDIA, See R. May, 1919, No. 639.

TILLAGE MACHINERY AND IMPLEMENTS. — Canada: 190759-190820-190913-190975-191082-191448 Harrows; 190824 Plough disk scraper; 190960 Stone collector; 191074 Lever for raising the plough bodies of a

multiple plough; 191355 Rotary cultivator; 191534-191656 Cultivators; 191606 Plough fore-carriage; 191715 Multiple balance plough.

France: 1st addition to patented invention No. 454975, Device to regulate hake knots of double two-way ploughs; 485834 vine mould plough adjustable by screw; 491831 Apparatus for measuring area of ground cultivated by plough or other farm implements; 492141 Plough; 492478 Improvements on cable-drawn ploughs; 492704 Improvements on ploughs and other propelled farm machines; 492887 Improvements on cultivators; 492917 System of plough and mechanical tractor combined; 492996 Device for mechanical cultivation of the soil; 493048 New type of plough all of iron and steel; 493218 Improvement on multiple ploughs; 493235 Improvements on ploughs, especially motor ploughs.

Netherlands: 3372 Multiple plough; 3412 Device for coulter plough body provided with spring; 3433 Regulating device for multiple ploughs; 3435 Fork machines for soil working; 3436 Device to regulate depth of motor ploughs; 3438 Device for fixing strakes to wheels of vehicles, especially cultural machines; 3512 Trenching motor plough.

New Zealand: 40352 Steering accessory for plough; 41159-41331 Attachment systems for tractor with plough or other farm implement; 40493 Cultivator.

Switzerland: 82198 Wheel with gripping plates for motor plough; 82199 Motor plough with 2 fore bearing wheels, one running in the furrow; 82200 Motor turnwest plough; 82201 Motor plough; 82202 Two segment roller for fields and meadows; 82368 Motor ploughs with 2 fore wheels and 2 rear wheels running two and two respectively in furrow and on headland; 82369 Multiple plough; 82370 Harrows.

United Kingdom: 125709-125806-126130 Ploughs; 125815 Hand hoe and seedling machine combined; 126198 Improvements to motor ploughs.

United States: 1302141-1302317-1303533-1303810-1304512-1304631-1304838-1304926-1305502-1305674 Cultivators; 1302146 Clod crushing roller; 1302339 Plough with raisable body; 1302403-1303518 Double furrow ploughs; 1303427 Plough fore-carriage; 1303516-1303517 Devices for automatically raising plough bodies; 1303769-1304058 Harrows; 1303813 Ridge plough; 1305099 Multiple plough and tractor combined; 1306705-1307408-1307918-1308676 Ploughs; 1306900 Cultivator with accessory seeder; 1307327 Wheel cultivator; 1308360 Rotary ploughing implement; 1308455 Attachment system for plough to tractor; 1308635 Harrow tine; 1308691 Cultivator combined with tractor; 1309299 Devices to regulate height of ploughs and other agricultural machines and vehicles; 1309408 Turn-west plough.

DRAINAGE AND IRRIGATION. — *Canada*: 191422 Excavator.

Netherlands: 3221 Screw ditcher with change speed; 3343 Vertical screw ditcher; 3349 Ditcher; 3475 Machine for digging drainage trenches.

MANURES AND MANURE DISTRIBUTORS. — *Canada*: 191303 Manure loader.

France: 492711 Manure spreading machine; 493187 Improved process and apparatus for treating soil to increase productivity; 493325 New

process of granulation for calcium cyanamide to favour its use as ammonia-potash manure (cyanamide treated with water containing silicate of potash).

New Zealand: 40378 Use as manure of flax residues (ash, liquor).

United Kingdom: 125718 Manufacturing process for phosphatic and potash manures; 127424 Manure and seed sower; 127549 Manufacturing process for sulphate of ammonia.

DRILLS AND SEEDING MACHINES. - *Canada*: 190821 Planter; 191088 Potato planting machine; 191255-191690 Maize sower; 191279 Cottonseed seeder.

France: 493404 Potato, etc. planter.

Netherlands: 3506 Rape seeder, etc.

United Kingdom: 125538 Distributor for seeder; 125815 Seeder combined with hand hoe; 127112 Seeder; 127424 Seed and fertiliser drill.

United States: 1302428 Combined manure sower and distributor; 1303264-1305500-1306823-1308252-1308679-1308888 Seeders; 1304321 Rotary seeder; 1304992-1308163 Maize seeders; 1305273 Hopper for seed drill; 1305850 Combined seeder and cultivator accessory for a plough; 1306000 Accessory seeder for cultivator

VARIOUS CULTURAL OPERATIONS. *Canada*: 19134 Straw transporter and spreader; 191648 Garden frame; 191026 Gardening instrument; 191033 Potato cultivator.

Netherlands: 3446 Pipe for warming the soil surface in nurseries and for maintaining its moisture.

Switzerland: 82202 Two segment roller for meadows and fields; 82374 Weeder.

United States: 1303602 Beet cultivator; 1306209 Machine to facilitate the fertilisation of alfalfa flowers.

CONTROL OF DISEASES AND PESTS OF PLANTS. - *Canada*: 190822 Fruit tree sprayer on wheels 191371-191530-191679 Apparatus for weed killing.

United States: 1305493 Plough for destroying cotton boll weevil; 1305059 Harrows with attachment for destroying locusts.

France: 491902 Animal-drawn sprayer for farm work; 493112 Apparatus for utilising the insecticidal properties of smoke.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. - *Canada*: 190735-191126-191277 Shockers; 190793 Reaper; 191046 Maize stem pulling machine; 191050 Hay rake; 191068-191120 Fruit picker; 191107 Bean plant cutter; 190138 Water plant cutter; 191144-191145 Mower blades; 191152 Reaper frame; 191170 Cabbage-cutting instrument

British India: 4504 Tea-picking machine.

France: 492061 Hand binder; 493077 Mechanical mower-cutter; 493527 Mechanical rake transformable into haymaker.

New Zealand: 41154 Grass scythe.

Switzerland: 82372 Detachable scythe fitting for laying cereals.

United Kingdom: 126473 Flax pulling machine.

United States: 1301829-1304797 Cutters for seed legumes; 1303298-1306317-1309568 Maize reapers; 1303606 Tractor mower; 1303899

Horse rake delivery spring; 1304638 Reversible gear for horse rake delivery; 1306242 Reaper blade; 1306703-1307191 Shockers.

MACHINES FOR LIFTING ROOT CROPS. — *Canada*: 190901 Beet puller and toppler; 190917-191138 Potato lifter; 191134 Ground nut lifter; 191567 Beet puller.

United States: 1301857 Potato lifter; 1302118-1302259-1303857-1303858-1304486-1306586-1306673-1307272-1307640 Beet pulling machines; 1308921 Beet toppler.

France: 491866 Beet or other similar root-pulling machine.

Netherlands: 3222-3498 Potato lifters; 3339 Flower bulb, etc., lifting machine.

THRESHING AND WINNOWING MACHINES — *United States*: 1304765 Pea sorter; 1306239-1306870-1308496 Grain sorters.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada*: 190908 Silo cover; 191214 Silo fodder chopper; 191305 Straw stacker; 191749 Grain cart.

France: 492436 New device with jointed fork for straw and hay lifters, called "Stack-builder".

New Zealand: 40232 Flax scutcher.

United States: 1302030 Straw and hay stacker; 1303552 Maize elevator; 1303644 Extensible hay loader; 1304001 Silo fodder chopper; 1305344 Automatic fodder press; 1305420-1306748 Hay stackers; 1305607 Mechanical feeder for lucerne hay milling machine; 1306462 Hay loader; 1306597 Sheaf loader; 1307754 Machine for drying, transporting and stacking hay; 1308397-1308645 Hay presses.

FORESTRY. — *Canada*: 191732 Stump remover.

France: 492105 Instrument for tapping Hevea.

Switzerland: 82373 Device for binding faggots; 82375 Instrument for unearthing and uprooting plants having long taproots.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada*: 191222-191519 Tractors.

British India: 4511 Tractor.

France: 492166 Farm tractor; 493036 French farm tractor; 493285 Tractor.

New Zealand: 40291 Wind motor; 40352 Steering accessory for plough; 41159-41331 Coupling for tractor to plough or other farm implement; 41309 Tractor.

Netherlands: 3438 Device for fixing grips to wheels of vehicles, especially cultural machines.

United States: 1301976-1302023-1302295-1305385-1305433-1305448-1305481-1305506-1305932-1306469-1306579-1306644-1307330-1307555-1307904-1307944-1308790-1309053-1309085-1309408-1309578 Tractors; 1302269-1309010 Tractor wheels; 1305099 Combined tractor and plough; 1305789 Wind motor; 1308445 Coupling for plough to tractor; 1308691 Tractor combined with cultivator.

FEEDING OF LIVE STOCK. — *Canada*: 191065 Manger arrangement;

191384 Water trough; 191505 Pig oiler; 191531 Pig trough; 191555 Calf feeder; 191683 Cattle feeder; 191648 Horse shoe.

France: 492349 Sulphurating chamber and production process for sulphuric anhydride for the treatment of all parasitic diseases of horses, principally mange, and also for the disinfection of all contaminated objects; 402822 Process and plant for rapid cooking and drying of fresh blood as animal food; 403469 Stock food and manufacturing process (vine shoots mixed with other ingredients).

New Zealand: 39434 Sheep dipper; 40395 Food mixer for live stock.

Switzerland: Cattle chain clasp.

United Kingdom: 127388 Stock feed (moss, peat or other cellulose material, exposed in autoclave to the action of a concentrated hydrolysing agent and superheated steam).

United States: 1303017-1304107 Pig feed distributor; 1305965 Automatic oiler for pigs; 1308806 Pig water trough; 1308901 Automatic pig feeder; 1309497 Cow supporter.

POULTRY FARMING. — *Canada*: 191510-191617 191618 Incubators; 191541 Poultry rearer (foster mother).

FISHERY. — *France*: 492541 New method of fishing with light.

INDUSTRIES DEPENDING ON PLANT PRODUCTS — *New Zealand*: 40037-40992 Oil filters; 41188 Apparatus for extracting plant juices.

Netherlands: 3157 Preparation process for a vegetable milk and its derivatives; 3345 Nut shelling machine.

United States: 1306991 Process and machine for decorticating cottonseed.

DAIRYING — *Canada*: 190902 Cleaner for separator discs; 191212 Support for milk pail.

Netherlands: 3378 Improved curd cutter and rake.

New Zealand: 39910-40286 Measures for milk from milking machines; 40117 Milking machine teat-cup.

United Kingdom: 126126 Milking machine; 127484 Process for making a soft cheese from skim milk.

United States: 1307539-1307929-1308053 Milking machines.

VARIOUS. — *Canada*: 190790 Cattle counter; 190834 Wire stretcher.

1226 — **The Beccari Fermentation Chambers.** RACAH, V., in *L'Italia Agricola, Giornale di Agricoltura*, Year LVJ, No 8, p. 242-247. 3 figs. Piacenza, August, 1919.

FARM
BUILDINGS

The "fermentation chambers" or "zymothermic cells" of BECCARI, already taken up on various farms for the treatment of farmyard manure and in several towns for the rotting of household and street rubbish, which will shortly be introduced in a number of Italian towns, are based on the principle of the fermentation in a closed space of the material to be humified. In this way the temperature rapidly rises to 60° and 65°C. and reaches 70-75°C., and the organic matter passes at once from putrid fermentation to manure fermentation and in a short time (40 to 50 days) is transformed into a homogenous mass completely disintegrated

and humified, almost odourless, easy to handle and transport, free of disease germs, and rich in fertilising principles. Practically speaking, while a good farmyard manure obtained from manure heaps rarely contains over 15 per 1 000 of nitrogen many analyses of manures from the Beccari chambers have shown that the latter manure has a nitrogen content varying from 6 to 9 per 1000 in chambers filled with manure and from 9 to 11 per 1 000 in chambers filled with household refuse.

In these chambers, the ammonia vapours which as a result of the high temperature are formed in relatively small quantity at the beginning of the fermentation, can be retained and fixed by an ingenious arrangement which is peculiar to this system. The arrangement consists of a partitioned turret on which is placed earth or suitable material (plaster, superphosphate, wood cinders) acidified with sulphuric or hydrochloric acid. In the former instance, the ammoniacal products absorbed by the earth are nitrified by nitrifying bacteria, the usual hosts, which, being favoured by food, moisture and warmth conditions multiply rapidly. This earth, rich in nitrates and nitrifying bacteria can be used as a complementary fertiliser for quick-growing crops (vegetables, tomatoes, tobacco, maize), or can be added to the manure made in the chamber when being applied to the land, thus rendering it more effective and quick-acting. On the other hand, when the above-mentioned acidified materials are placed over the turret, the ammonia salt corresponding to the acid will be obtained.

The fermentation chamber (see Fig.) consists of a mason work cell (18) of size (which may be built totally or partly in the ground or above ground) according to the quantity of material to be dealt with, this cell, in the form of a rectangular parallelepiped, is bounded by 4 walls 2.5 metres high and divided into two compartments by a partition. The floor is on a slight incline with a drain (10) covered over with perforated bricks not built together but simply laid flat, so that they may be easily cleaned when the spaces between them and the holes become clogged up through this drain there enters by the small aerating chamber (13) the air necessary to start fermentation in the mass of manure or rubbish, while, inversely, the liquid draining from the mass runs into the small collecting channel (11), where likewise the farm stable urine may be made to drain. The two compartments (18) have filling openings (8) of about 100 cm. diameter on their upper parts, for throwing the manure into the chambers direct from the cattle sheds.

At the middle of each of the two compartments, on the outside, there is an outlet door which may be of wood, sheet iron, or a sort of boarding; on the outside, between the two doors, there is the small liquid manure channel (11). Above the chamber is the masonwork turret, inside which is a series of partitions (3) made of planks or metal sheets or perforated earthenware. These partitions are fixed so that one fits into the wall at one side of the turret and the next one fits into the side opposite, so that the openings are away from each other and there is a serpentine passage through. The gases issue from the fermentation chambers and enter the turret through communication holes (7). The turret may

also be made of reinforced concrete and consists of sections set one on top of another having alternating openings in the bottom or lateral communication. An opening or a series of openings serves to fill or empty the partitions with earth or other fixing substances for the volatile products. Above the turret there is a draught chimney and at its base two holes allow a moderate quantity of air to penetrate. If the fermentation chamber is built above ground, a ladder (14) must be provided to give access to the top part.

BECCARI fermentation chamber plant.

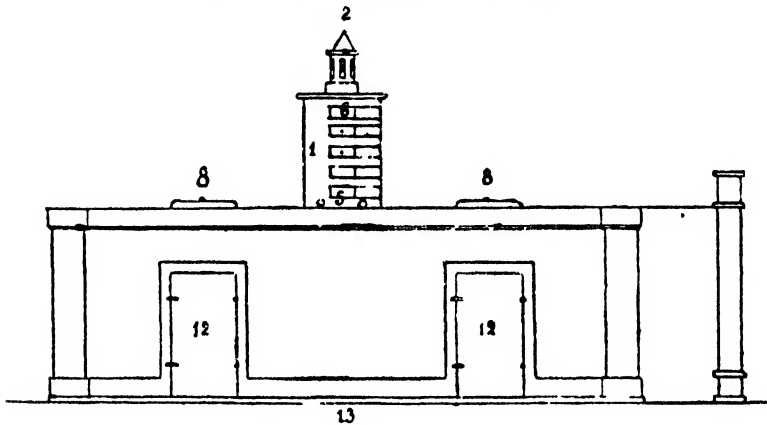


Fig. 1 Front view

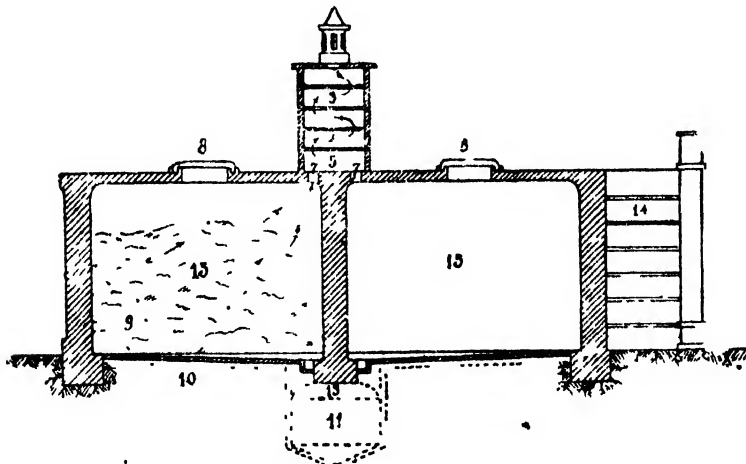


Fig. 2. — Vertical section.

The manure, as it is produced, is thrown by the filling door into one of the two compartments and well sprayed with the liquid from the small channel; litter will be placed there every 2 or 4 days; the material must

be spread out uniformly. To empty the chamber, the outlet door is opened. While a chamber is being filled, humification is going on in another. The latter finished (i. e. after 40 days from the end of charging) the manure may be spread directly on crops or put in pits where it should be well pressed down and covered with earth.

The most varied kinds of rubbish can be put to ferment in the BECCARI chambers without the composition of the final product, according to analyses made in different Italian towns, showing any great divergences in the quantities of materials useful for agriculture: on the average there are per 1 000 kg. of rubbish treated: 3.4 kg. nitrogen — 3.7 kg. phosphoric acid — 0.64 kg. potash. The mass put in to ferment diminishes in bulk about 25 % but its weight remains about the same on account of the moisture added by spraying.

Experiments carried out by Prof. GASPERINI, Director of the Sanitation Department of Florence, show that street sweepings undergo absolute sterilisation in the fermentation chambers, after only a few days of fermenting, intestinal worms and nematodes, spores and bacilli of all infections and contagious diseases are destroyed. On the 21st day the spores of smut are completely destroyed. It is probable that the sterilising effect is due to the combined action of the high temperature, moisture, gases in the nascent state (sulphuric anhydride, hydrogen phosphide, etc.) and biological conflict between the different germs.

The value which the extended application of Beccari's system may acquire will be seen by considering that a town of 100 000 inhabitants produces in 1 year 18 million kilogrammes of household and street rubbish which, if treated under the system in question would yield 62 000 kg. of nitrogen — 60 000 kg. of phosphoric acid — 11 520 kg. of potash, of a total value at pre-war prices (at present three times greater) of 127 000 fr.

RURAL ECONOMICS.

1227 — **Farm Rent Contracts in Italy.** — PAPI, C., in *Atti della R. Accademia dei Georgofili*, Year 166, No. 1, pp. 8-37. Florence, April 30, 1919

The subject elaborated in this memorandum on contracts relative to rural property, read at the assembly of February 9, 1919, of the "R. Accademia dei Georgofili" is a commentary on the Regent's Decree of June 30, 1918, No. 880, which admitted the participation of the proprietor of the farm let to the surplus revenue resulting from the war, in order to study the problem concerning the extent of this participation and the disputes it may give rise to.

The author notes in in the first place that the system of exploiting the farm by farm rent, which is common in central Italy and Umbria, the parts in which the author is mostly interested, has become at a relatively recent period of the most notable economic and social importance.

The spirit of enterprise shown by the big modern farmers, and the industrial capital they have largely used in their exploitations, have often enabled the proprietors to increase the land revenue at each renewal

of lease, and have likewise been the cause of an improvement in conditions for the metayer farmer, who has been able to benefit from the farmer's good management.

In the author's opinion, farm renting offers the means of dividing the periodical flux of wealth called revenue in the land rent (in RICARDO's meaning of the terms) and in the profit, the rent being the price of farming freed from the charges which fall on the landlord, and the profit all services which the farmer obtains from lesser funds: the price of farming, running expenses, interest on industrial capital involved, remuneration for personal work.

During the war, especially in 1918, the cost of foodstuffs, principally stock feeds, underwent so unforeseen a rise that, in spite of great difficulties against which the producer had to struggle, not only was there an increase (generally more than double) in the gross revenue expressed in kind, but also the net total revenue increased (rent and profit together in direct valuation exploitations) to a very remarkable extent, compared with the period immediately before the war. On the other hand the greater services rendered by land capital required a higher remuneration for the latter and caused, in general, the increase in land capital value. Not only does the change in current contracts rest on equitable economic bases, but it is also made necessary for reasons which are of political importance especially as regards the proprietary deeds of farm land.

The Decree admits the proprietors' right to demand an increase in the price of the farm rent, not exceeding 20 %, when the farmer enjoys an income of double what he got from the land farmed during the two-year period 1912-13. The extent of 20 % of the farm rent, established by the Decree, expresses algebraically, in terms of this price, the idea of division in half of excess profit: thus, if before the war in the normal verifications of farmers' incomes for the application of the tax on personal wealth, the amount of 20 % of the price of the land was fixed, then in order that the increase up to 20 % may be made, an income double that before the war must be declared, viz over 40 % of the price of the farm rent. Evidently this means of verification offers advantages from the standpoint of simplicity in application. But, as the author observes, to fix logically the scale of increase in the land rent, the extra profit according to wartime prices would have to be estimated and, by the use of coefficients of probability and prudence, considering present circumstances, the commercial value of the extra profit would have to be calculated so as to attribute it to the proprietor leaving the rest to the farmer. This method agrees with the principles governing farm rent, viz. that it is the farmer who runs the risks, the compensation for which he finds in eventual higher profits.

According to FISCHER, if S_r denotes the extra profit *without risk*, m the coefficient of probability, n the coefficient of prudence, then the mathematical value of the extra profit will be equal to the value without risk for the coefficient of probability, and the commercial value V_c will be equal to the mathematical value for the coefficient of prudence. Thus calling the product of the two coefficients (mn) the coefficient of risk, the

commercial value would equal the value without risk multiplied by this coefficient: $Vc = mnSr$. If the value $\frac{60}{100}$ be assigned to the coefficient of probability and $\frac{5}{6}$ to that of prudence, then the commercial value of the extra profit, viz. what a prudent man would be willing to pay in order to acquire the right to take the future extra profit, estimated at war prices, of the farm involved, would be: —

$$Vc = \frac{60}{100} \times \frac{5}{6} \times Sr = \frac{50}{100} Sr.$$

The proprietor would get the commercial value of the extra profit and the farmer would get the difference between the extra profit without risk and the commercial value. By this hypothesis the commercial value of the extra profit would be reduced to one half, and the other would remain to the tenant.

This equitable measure of the half, fixed by the Decree of June 30, 1918, for distributing the extra profit, has for basis the coefficients of probability and of prudence just examined. The part of the Decree which in practice may, in the author's opinion, give rise to most disputes is that concerning the modifications in conditions of contract which decide the restitution of livestock and implements and buildings.

In Umbria, a district especially kept in view by the author, the general custom is that the proprietor gives the estate a certain quantity of livestock expressed in value, and at the time of delivery to the farmer, the experts of the parties value with prudence, at current prices, the existing livestock; if the difference between the value of the livestock estimated and the settlement fixed is positive, it is paid in kind by the tenant to the owner and viceversa.

On the other hand, implements and buildings are handed over with a description as to their quantity and quality, without assigning them a value which in many cases could be only arbitrary as a large part of these goods is not the object of ordinary trading and at the end of the lease the goods are given back in the same quantity and quality, making up differences with the help of prices sometimes fixed by the contract and sometimes fixed by experts.

The variations in the unit price on the livestock market in economically static periods are only a coefficient of the risk inherent to all land rent contracts. The restitution of the livestock leased at current prices may, on the other hand, make it absolutely impossible for the proprietor to get back the amount let out.

The author has looked up, for Umbria, the prices of cattle in the century previous to the war and also during the war, in accounting papers left by the Benedictines of Mont Cassino, who were formerly owners of the Casalina farm, now annexed to the Royal Higher Agricultural Experiment Institute of Perugia.

Table I shows the prices according to ten-year periods; those per quintal of live weight of draught oxen, are based on an average weight of 18 quintals per pair.

TABLE I. — *Price of oxen from 1820 to 1919.*

Years	Price of a pair of working oxen	Price per quintal live weight	Years	Price of a pair of working oxen	Price per quintal live weight
	<i>Lire</i>	<i>Lire</i>		<i>Lire</i>	<i>Lire</i>
1820	585	32 50	1900	992	56
1830	548	30 50	1910	1 800	100
1840	580	32 50	1914	1 760	96
1850	670	37 50	1915	2 620	145
1860	888	49 50	1916	2 860	160
1870	897	50 00	1917	3 800	211
1880	1 147	61 00	1918	12 600	700
1890	1 298	72 00	1919	—	(1)

(1) The series of prices does not lend itself to interpolations

The prices (per quintal of live weight) of cattle ruling on the Perugia market during the years immediately before the war and during the war are shown in Table II.

TABLE II. — *Price of various kinds of cattle on the market of Perugia from 1910 to 1918.*

Years	Working oxen	Oxen for butcher	Cow for butch'ry	Calves
	<i>Lire</i>	<i>Lire</i>	<i>Lire</i>	<i>Lire</i>
1910	85-125	80-110	65-95	95-130
1911	90-130	85-110	75-102	100-160
1912	80-120	85-102	60-90	90-150
1913	75-125	70-97	60-88	80-130
1914	75-102	70-86	60-80	80-115
1915	80-210	75-100	60-130	90-170
1916	145-225	120-165	115-150	110-165
1917	165-260	145-215	135-190	130-210
1918	800-1000	requisition price (1)		300-810

(1) From May, 1918, dealing in butcher cattle has been controlled and these cattle were commandeered in central and northern Italy at a maximum price of 330 lire per quintal live weight for oxen, 320 for young bullocks, 310 for cows and 300 for calves.

Table III shows the prices current on the market with some slight variations, also for the delivery and returning of goods other than live stock.

The figures in Table III show plainly the enormous difference in value between stock on the farm during the war and stock at present there.

The author estimates that the share of the proprietor in the extra value of the stock should be limited to the part which the said proprietor delivered to his tenant.

TABLE III. — *Current prices of goods leased.*

		Per kg. live weight
<i>Livestock leased: —</i>		---
Draught oxen . . .	<div> <div>from 4 to 7 years old</div> <div> " 8 to 9 " "</div> </div>	<div> <div>8-9 <i>Live</i></div> <div>6.50-7</div> </div>
Good grade cows, 3 to 7 years old, in calf or sucking calf .		7.50-8
Aged cows		6-7
Cows past use		4.50-5
Calves 4 months to 2 years for breeding purposes		7-8
Calves for butchering		4.50-5
Young oxen, broken in, 2 to 4 years		9-9.50
Sows of good breed, served or sucking		9.50-7.50
White young pigs (crosses)		12-13
Black young pigs of local breed		8-10
Fat pigs (price of tax)		5.25-6.50
Breeding ewes, with lamb or sucking lamb		5-5.50
Ewes for butchering		2.50-3
<i>Goods leased: —</i>		per quintal
Hay	<div>first quality in stack</div> <div>second quality</div>	<div>20 <i>Live</i></div> <div>14</div>
Straw	<div>wheat</div> <div>oats</div>	<div>8</div> <div>10</div>
		per cubic metre
Manure	<div>cattle</div> <div>sheep</div>	<div>5 <i>Live</i></div> <div>8</div>

When this part is expressed in **cash**, as live stock leased out, the author proposes to work as follows: — After finding the average between the different categories of livestock normally kept on the farm, he finds out the *cost at the cattle sheds* per quintal live weight at the time of delivery and, dividing by this unitary price the settlement of the livestock leased out, expressed in kind, he obtains from it the live weight. Then he applies to this live weight the current *cost at the cattle sheds*, and the difference between the two settlement values constitutes the part of the cattle sheds profits to be divided according to the metayage regulations in half with the worker tenants. Of the half which comes to the farmer one part constitutes his normal profit and the other the extra war-profit. Investigations on price variations enable the *price at the cattle sheds* which would probably have obtained in the absence of war to be determined with sufficient approximation. On applying this price to the live weight at the time of settlement, calculated above, the difference is the extent of extra profit arising from the war which the farmer gains with the help of the stock profits he divides equally with the worker tenant. The extent of the proprietor's share in this extra

profit is decided in this case also, says the author, on taking into account the element of risk.

The opposed interests of farmer and proprietor may in this case come to an agreement in the risk factor, which holds good for both parties and may be fixed with some probability in the measure of $\frac{50}{100}$. The commercial value of the farmer's extra profit would thus be reduced to half, while the other half would constitute the bonus which the farmer would give the proprietor at the time of valuing the stock and goods leased out.

The estimation value of an animal at *cattle shed price* is, according to the author, the amount of the price which the animal would fetch on the market in the period theoretically most opportune for selling, less the difference between maintenance costs and the products furnished from the day of estimation until the day of the sale, multiplied by the coefficients of probability and prudence. The cost at the stable thus determined is generally lower than the market cost, sometimes higher, as in the case of very young calves.

For the implements, buildings, etc., leased out, it is generally sufficient to refer them to the land rent contract, these goods being either delivered with their value mentioned or simply described. The author puts forward on this point some interesting observations, but without speaking of modifications to be proposed for the land-rent contracts which are the subject of this study.

1228 - A Five Year Farm Management Survey in Palmer Township, Washington County, Ohio, 1912-1916. — HAWTHORNE, JI W., in *U S Dep of Agric Bulletin*, No. 716; pp. 1-54. Washington, 1918

This bulletin presents a study of a farm management survey of 73 southeastern Ohio hill farms on 25 of which the survey was conducted for five successive years, 1912 to 1916 inclusive. The findings for the area surveyed, though strictly applicable only to the farms surveyed, offer valuable suggestions to farmers located on the numerous similar areas of Pennsylvania, Ohio, Indiana, Illinois, West Virginia and Kentucky.

Objects of the study. The objects of this study were

1. To ascertain the type of farming followed and the profits realised in a long-established agricultural community of the hill country of Ohio where the price of land is comparatively low and railroad points are reached with considerable difficulty.

2. To determine the importance of such factors as the size and the quality of the farm business as they affect the economic organisation of farms in such an area.

3. To bring out the farm practices that enable some farmers to excel others in single enterprises or in the entire farm organisation.

4. To determine how nearly the farm profits of a single year in such an area are indicative of those realised over a period of years.

5. To note agricultural changes that may take place during a five-year period in such an area.

6. To determine the yearly variations in crop yields, in prices received for products, in the quantities of the several products available for sale, and in the expenses of operating the farm business, and, so far as practicable, their effect upon the farm profits of the area.

TABLE I. — *Summary of the farm business of 25 farms for a period of five years 1912-1916 (Palmer Township, Washington County, Ohio).*

Item	Averages of farms by years					Five year average
	1913	1914	1915	1916		
Farm area acres	155	156	156	154	156	156
Crop area "	41	42	39	44	46	43
Number of productive animal units	135	141	153	149	161	149
Number of work stock . .	26	27	26	28	27	27
Investment \$	6087	6211	6422	6527	6639	6378
Receipts "	868	796	931	916	1112	925
Expenses "	412	375	423	430	456	419
Farm income "	456	421	511	486	656	506
Interest on investment at 5% "	304	311	321	326	332	319
Labour income "	152	110	190	160	321	187
Value of farmer's labour	288	281	295	290	298	290
Per cent on investment (1) . %	2.5	2.2	3.4	3.0	5.4	3.4
Farm income \$	456	421	511	486	656	506
Value of unpaid family labour "	86	85	92	90	82	87
Family income (2) "	512	506	603	576	738	593
Interest paid on indebtedness "	19	19	11	12	6	14
Amount available for family living "	523	487	590	564	732	579
Percentage of five year average						
Crop yields %	110	89	94	106	101	—
Receipts per animal unit . . "	93	97	99	98	113	—
Price received for farm pro- ducts "	91	98	99	100	112	—
Quantity of farm products sold "	108	81	101	101	109	—

(1) After deducting farmer's labour from farm income

(2) The sum of farm income and value of unpaid family labours, or the amount available for family living had there been no interest to pay

Summary of results. — For five years the average annual sales of 25 farms were \$ 925 per farm and of this amount 45 per cent. was required for operating expenses. With a fair rate of interest allowed on the investment the labour income averaged \$ 187. Or with a fair wage allowed for the far-

mer's labour, the return on the investment was 3.4 per cent. This was in addition to the value of food products, fuel, and use of house furnished by the farm without money cost. The value of such items was \$ 325. The farms averaged 156 acres, worth \$ 30 per acre. One-half of the land was in pasture and one-fourth in maize, wheat, and hay. The crops were mostly fed to beef cattle, poultry, fine-woolled sheep, hogs and work stock. Practically 75 per cent. of the receipts was from the sales of live stock, including eggs, wool, and dairy products.

So far as profits were effected, one year was good, one poor, and three might be considered normal. Profits varied widely. Some farmers made more than enough to support their families and were enabled to reduce indebtedness, improve their farms, buy more land, or make other investments, others realised no more than enough to supply the necessities of life. The two outstanding factors affecting such differences were the size and quality of the business. On small farms with poor crop yields and a poor quality of live stock, the sales but little more than covered expenses. On large farms, with good crop yields and good live stock, the sales far exceeded the expenses.

In five years there was a decided change from sheep to cattle. Sheep decreased 58 per cent and cattle increased 68 per cent. The decrease in sheep was greater on farms that keep sheep primarily for wool production than on farms selling lambs and wool.

When the study began, butter was the only dairy product sold; at the end of the five year period several farmers were selling cream.

The sale of dairy products increased \$ 50 per farm. Putting up silos aided several farmers to carry more live stock.

Maize yielded 44 bushels per acre for the five-year average, wheat 14 bushels and hay 1.2 tons. Yields for the different crops were 50 to 100 per cent. better some years than others, but in no case did all the good yields or all the poor yields fall in a single year. The amount of feed raised each year varied less than the yields of individual crops.

TABLE II. -- *Percentage distribution of receipts.*

	5 year average					
Crops receipts %	26	10	16	20	16	18
Live stock receipts	67	73	75	72	75	73
Miscellaneous receipts	7	17	9	8	9	9
Receipts from cattle (1)	19	27	23	28	31	26
Horses and colts	4	1	3	1	1	2
Sheep and wool	20	12	13	12	12	14
Hogs	7	13	16	13	13	12
Poultry and eggs	17	20	20	18	18	19

(1) Includes sale of dairy products.

Price levels increased 23 per cent. from 1912 to 1916, and operating

expenses 12 per cent. There were much wider variations in the amount of crops sold than in the live stock sold. For two years the quantity of all products sold approximated the five-year average, for two years it was above the average, and for one year decidedly below. A brief summary of the business conducted on these farms is presented in Table I. The data shown are averages for the 25 farms for each year from 1912 to 1916 with the five year average in the last column.

The percentage distribution of receipts is shown in Table II.

The percentage distribution of the farm investment in this area from 1912 to 1916, inclusive, together with the five-year average, is shown in Table III.

TABLE III. — *Percentage distribution of investment.*

Item	1912	1913	1914	1915	1916	5 year average
Land	46	47	45	45	44	46
Dwelling	16	16	16	16	16	16
Other buildings.	14	11	13	13	13	13
Real estate	76	76	74	74	73	75
Live stock	13	15	16	16	17	15
Machinery	5	5	5	5	5	5
Food and supplies	3	3	4	4	4	4
Cash	1	1	1	1	1	1
Working capital	22	24	26	26	27	25

1229 — **Breed and Size of Cows as Factors Affecting the Economy of Milk Production.**—

NIVEN, W. B. (University of Nebraska) in *Journal of Dairy Science*, Vol. II, No. 2, pp. 96-107, Baltimore, March 1910

In considering the relation of breed and size of cows as factors affecting the economy of milk production it is not always possible to draw sharp distinctions and to attribute any one phenomenon to either factor alone. Hence these factors are considered together. Small animals have a greater surface in proportion to their weight than large animals, and therefore a greater radiation of heat per pound of live weight. A ratio has been worked out showing the relation between the maintenance requirement of animals of different weight. The daily maintenance requirement for cows is shown in Table I.

The maintenance requirements of a 1500 pound cow instead of being 50 per cent. greater than those of a 1000 pound cow, as might be expected, are but 31 per cent. greater in the case of protein and but 32 per cent. greater in the case of energy.

TABLE I.
Daily maintenance requirement for cows (1).

Weight —	Digestible true protein — lb.	Therms net energy —
750	0.413	4.95
800	0.431	5.17
900	0.466	5.59
1000	0.500	6.00
1100	0.533	6.30
1200	0.565	6.78
1300	0.596	7.15
1400	0.636	7.51
1500	0.655	7.86

The records of cows entered in the Wisconsin cow competition, sorted according to live weight and breed, given in Tables 2 and 3, show that while large cows do consume more feed than small cows, the amount of feed consumed per pound of live weight of the animals is greater in the case of the small cows than with the large ones. Although the larger cows consumed less feed in proportion to size than the smaller ones they produced milk, total solids and butter-fat with greater economy of feed. While the economy of production does not increase uniformly with greater size of cows, there is a very significant increase in economy when all the classes of cows within each breed are considered. In milk production those cows in the heaviest class of Holsteins returned 29.2 pounds more milk for each 100 feed units than did the cows in the lightest class. Similarly, the largest Guernseys returned 20.5 pounds more than the smallest, while the heaviest cows of the Jersey breed were also much more efficient, returning 21 pounds more milk per 100 feed units than the lightest class of Jerseys.

In production of total solids a like relation holds true, there being a difference in economy of production in favour of the heaviest cows over the smallest to the extent of 3.43 pounds for the Holsteins, 2.83 pounds for the Guernseys and 3.02 pounds for the Jerseys.

In butter-fat production there was, of course, a much smaller numerical difference, but a relationship similar to that of the two instances just mentioned. The largest Holstein and Guernsey cows produced 1.04 pounds more butter-fat than the smallest cows of their respective breed, while the largest Jerseys produced 1.06 pounds more.

Considering the average production of all the cows of each breed, the 148 Holsteins produced milk and total solids much more economically from the standpoint of feed than the 141 Guernseys or the 76 Jerseys. This is a very important point commercially if the milk were sold by weight

(1) Cfr. PUTNEY, F. S., and ARMSBY, H. P.: Computation of Dairy Rations, in *Bull.* 143, Penn. Agr. Exp. Station.

without regard to test. The Holsteins produced 54.1 pounds more milk from each 100 feed units than did the Guernseys. At \$ 3.00 per 100 pounds this would be worth \$ 1.62. The 58 9 pounds of milk which the Holsteins produced in excess of that produced by the Jerseys would, at the same price, be worth \$ 1 77. This, therefore, is a very important item to consider when selecting a breed of cows to furnish milk to a whole milk market.

TABLE II.
Records of cows entered in Wisconsin cow competition

Class	Number of cows	Average live weight pounds	Milk pounds	Solids pounds	Fat pounds	Feed Units
<i>Holsteins</i>						
1000 and less	10	927	13 192 7	1 589.6	456 93	7 905
1001-1100	21	1 081	14 141 7	1 689 1	483 15	7 443
1101-1200	42	1 170	14 089 5	1 683.6	480 73	7 650
1201-1300	25	1 274	15 616.5	1 805 6	529 27	8 145
1301-1400	26	1 377	16 441 7	1 845 1	527 86	7 950
1401-1500	10	1 475	15 495 9	1 875 0	544 71	8 180
1501 and over	8	1 669	17 017 1	2 042 4	592 07	8 675
<i>Average</i>	—	1 225	14 712.3	1 833 2	505.32	7 890
<i>Guernseys</i>						
800 and less	5	762	9 935 6	982 5	351 36	5 989
801- 900	32	863	7 579 4	1 073 8	384 24	6 109
901-1000	56	962	8 623 0	1 208 8	427 633	6 394
1001-1100	29	1 068	9 165 4	1 270 3	444 794	6 739
1100 and over	19	1 202	9 146 7	1 334 0	479 111	6 930
<i>Average</i>	—	987	8 546.9	1 199 7	425.55	6 458
<i>Jerseys</i>						
800 and less	10	766	6 065 5	862 5	309 51	4 985
801- 900	34	866	7 031 8	970 2	360 87	5 614
901-1000	21	945	7 180 3	1 038.4	375 99	5 666
1000 and over	11	1 109	7 897 9	1 124 6	402.46	5 535
<i>Average</i>	—	909	7 063.0	997.17	384.31	5 534

Total solids in milk form the valuable constituent of condensed and evaporated milk and milk powder. The Holsteins produced milk solids much more efficiently than either the Guernseys or Jerseys.

In butter-fat production the order of economy of production by the different breeds is changed. The Guernseys were most economical, producing 0.01 pound more from each 100 feed units than the Jerseys and

0.19 pound more than the Holsteins. The difference is great enough to be of considerable importance when the product is sold entirely on the basis of butter-fat.

TABLE III.

Number of feed units consumed per pound of live weight and pounds of products per 100 feed units of cows in Wisconsin cow competition.

Class	Number of cows	Average live weight pounds	Feed units per pound live weight	Products per 100 feed units		
				Milk	Solids	Fat
				pounds	pounds	pounds
Holsteins						
1000 and less	16	927.0	8.53	166.9	20.11	5.78
1001-1100	21	1 081.0	6.97	187.5	22.39	6.41
1101-1200	42	1 170.0	6.54	184.2	22.01	6.28
1201-1300	25	1 274.0	6.39	191.7	22.90	6.49
1301-1400	26	1 377.0	5.76	206.8	23.21	6.64
1401-1500	10	1 475.0	5.54	187.8	22.92	6.66
1500 and over	8	1 669.0	5.19	896.1	23.54	6.82
Average	—	1 225.0	6.44	186.5	23.24	6.40
Guernseys						
800 and less	5	762	7.86	115.8	16.42	5.87
801- 900	32	863	7.08	124.1	17.58	6.29
901-1000	56	962	6.64	134.9	18.90	6.69
1001-1100	29	1 068	6.31	136.0	18.85	6.60
1101 and over	19	1 202	5.76	136.3	19.25	6.91
Average	—	987	6.54	132.4	18.59	6.59
Jerseys						
800 and less	10	766	6.51	121.7	17.30	6.21
801- 900	34	866	6.48	125.3	17.28	6.42
901-1000	21	945	5.99	126.7	18.32	6.63
1001 and over	11	1 109	4.99	142.7	20.32	7.27
Average	—	909	6.09	127.6	18.02	6.58

AGRICULTURAL INDUSTRIES.

1230 - *Presses or Diffusion Batteries?* — SEMICHON, LUCIEN, in *Revue de Viticulture*, Year XXVI, Vol. LI, No. 1311, pp. 101-103. Paris, August 14, 1919.

In the manufacture of red wines the fermented residues should be extracted on leaving the vat in order to withdraw from them the wine they still contain. Two systems are in use: pressing and diffusion (by displacement of the wine with a slow current of water).

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The author examines these two systems, showing their respective advantages and drawbacks.

He estimates that the technical advantages with diffused as compared with pressed wines (less harsh wines, almost immediately clarifiable) are not negligible, but that it is often an illusion to think that diffusion gives *on the whole* more profit than does pressure. Frequently the opposite holds good. It is always the contrary on small and medium properties, which represent in France 95 % of the vineyards and 70 % of the production.

Hence, morally speaking, the argument acquires quite a decisive value against diffusion: it will be difficult to disabuse the popular mind of the idea that diffusion is a means of watering down wine without the effect being noticeable.

It has been fixed by law, in order to protect the "diffusers" against unjustified charges, that Excise officers must visit diffusion plant when it is working and take samples for comparison of the wine running from the battery and of press wine which vinegrowers have to keep separate until the official agent comes to inspect.

If the diffusion method were to become common, a considerable number of officers and chemists would be needed; and the necessity to keep apart press wines and diffusion wines is an annoyance which may become very serious.

Everything considered, the benefit in yield which diffusion can give as compared with pressing exists only on large estates. The monetary benefit — as distinct from the foregoing in consequence of the value of the residues for making "piquette" or for distilling purposes — is only rarely in favour of diffusion.

The author advises growers to use the most improved processes of pressing.

1231 — **Wormwood Used in Italy to Flavour Vermouth and in France to Denature Salt for Stock.** — See No. 1117 of this Review.

1232 — **Banana Cider (1): Wholesome Drinks in Indo-China.** — CHEVALIER A. (Director of the Scientific Institute of Saigon), in *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year 1, No. 7, pp. 214-216. Saigon, July, 1919.

In connection with the article recently published in the *Bulletin agricole de l'Inst. Scient. de Saïgon* by M. AUG. CHEVALIER on the Langbian apple tree (2), General LEBLOIS (Commander in Chief of the Troops in Indo-China), forwarded to the Director of the Scientific Institute a communication on the manufacture of banana cider in Indo-China. The following is a summary of the communication

Whatever the interest taken in obtaining real cider apples in Indo-China to obtain success in planting, grafting, etc. will evidently call for a fairly long period of time still. Meantime, an excellent cider may be made from bananas, as good as, if not better than, good French cider, and which can be sold very cheaply.

(1) As regards industrial products derived from bananas (wine, alcohol, etc.) see R. Nov., 1914, No. 1054. — (2) See R., July-Sept., 1919, No. 909. (Ed.)

It is excellent for the intestine and, unlike real cider, is slightly astringent, as are all tropical fruits. It has such a thirst-quenching power that General LEBLOIS declares he has never drunk a whole glass of it without feeling at once the thirst disappear. This drink is becoming more and more common in Indo-China.

RECIPE FOR MAKING. — Proportions for 25 litres of cider: — 125 gm. of "tea flowers"; 1.8 kg. of crystallised sugar; 25 gm. of tartaric acid; 6 very ripe bananas; 4 small cakes of Annam yeast.

Boil 5 litres of water, add the tea and let boil for $\frac{1}{4}$ hour uncovered. Pour the water, without the flowers, into a demijohn half full of cold water, add the sugar, tartaric acid, the bananas cut into pieces, and the yeast broken up and freed of rice husks. Stir the liquid for $\frac{1}{4}$ hour with a long bamboo, then fill up the demijohn. Allow to ferment for 5 or 8 days, remembering to stir a few minutes every day. Bottle and wire the corks. Leave the bottles a few days on their sides and set them upright if the corks blow out. Use round corks and a corking machine.

After the 7th day the bottled cider may be consumed, or even on the 5th and 6th days, according as it is preferred more or less sweet and more or less alcoholic.

M. Aug. CHEVALIER adds that there are variations in the quantities used in the making. Thus Dr. GUIBIER gives the following recipe:

For a cask of 110 litres, take 500 gm. tea flowers; 7 kg. sugar; 150 gm. tartaric acid; 10 ripe bananas; 40 gm. Annam yeast (*Saccharomyces*).

Boil the tea flowers in 15 litres of water, add the above ingredients and fill up the cask. Stir every day for 10 minutes with a stick. Fermentation is done after 4 to 5 days in summer, or 8 days in winter. Draw off and filter. When fermentation goes down, put in bottles. Wire the corks. Leave the bottles 3 days on their sides and then set them upright. Use champagne bottles as far as possible.

Some people substitute the ash leaves (*Fraxinus Ornus*) of the French herbalists for the tea flowers.

On the other hand, M. P. BUSSY, of the Saïgon Chemical Laboratory, sends the following recipe for making an aerated drink having the taste of "piquette" which is economical and pleasant to take with meals:—

Into a demijohn put 8 litres of boiled water, 3 bottles of white wine and 600 gm. of sugar. Add yeast (*Saccharomyces*). Stir. Leave to ferment for 6 to 7 days, then bottle (preferably in champagne bottles); cork with new corks which have been sterilised by boiling in water; wire and lay the bottles on their sides. Use after 8 days' time.

This drink may be greatly improved by adding to the mixture 2 bottles of the preceding preparation, which quickens the fermentation.

The wholesome drinks referred to above will certainly not displace the real French wines or Normandy cider, and home producers need not fear competition in this respect, but they will replace, doubtless with advantage, the alcoholic liquors too often sold under the name of "wine" in the Far East, which bring disrepute on one of the most valuable French national productions.

1233 - **Cholam (*Andropogon Sorghum*) as a Substitute for Barley in Malting Operations.** - VISWANATH, B., LAKSHMANA ROW, I., and RAGHUNATHASWAMI AYYANGAR, P. A., in *Memoirs of the Department of Agriculture in India, Chemical Series*, Vol. V, No. 4, pp. 117-129. Calcutta London, Jan., 1919.

At the Madras Exhibition of 1917, there were shown a series of malted foods of the type of Benger's and Mellin's foods and Horlick's malted milk, which were prepared by the use of malt obtained from "cholam" (*Andropogon Sorghum*) and "ragi" (*Eleusine coracana*). The use of these cereal grains for the preparation of malts was necessitated by the fact that barley is not produced in South India, with the exception of a comparatively small quantity in the Nilgiri hills.

Experiments made in Europe and America with barley, maize, wheat, rye and oats had shown that barley was the grain best suited for purposes of malting. The malting values of the various grains examined were (1):—barley 1.00; oats 0.30; maize 0.28; rye 0.93; wheat 1.08. Wheat malt, though slightly better than barley, has been discarded for general use as being too costly, so that barley is the grain almost universally employed for malting purposes.

The authors were desirous of finding a satisfactory substitute for barley among the following common South India cereals: paddy (*Oryza sativa*), cholam (*Andropogon Sorghum*), ragi (*Eleusine coracana*), tenai (*Setaria italica*), maize (*Zea mays*) and cumbu (*Pennisetum typhordeum*).

After a detailed description of their experiments, the authors summarise the results as follows:—

1) Cholam is better suited for malting purposes than the other above mentioned cereals.

2) Cholam malt extract hydrolyses soluble starch at a greater rate than barley malt extract.

3) In the case of hydrolysis of starch by cholam malt the proportion of dextrin to sugar produced is greater than in the case of barley malt, compared under identical conditions.

4) The products of starch hydrolysis by cholam malt consist, as with barley malt, largely of maltose and dextrine.

Cholam may be used wholly or partially as a substitute for barley. The absence of a sufficient proportion of husk in the grain is perhaps a disadvantage with cholam, but this defect can possibly be remedied by admixture with malted paddy or bran. Cholam is much cheaper and more largely available in India than barley and can, therefore, be used extensively there in brewing and in preparing the foods mentioned at the beginning of this article.

1234 - **The Production of Glycerin by Fermenting Molasses.** — LING, A., in *The Brewers' Journal* June 15, 1919: summarised in *Brasserie et Mallerie*, Year IX, No. 9, pp. 139-142. Nancy, July 20, 1919.

The production of glycerin by alcoholic fermentation (2) was studied

(1) MARTIN, G., *Industrial Organic Chemistry*, p. 286. (Authors' note).

(2) In a review furnished with a copious bibliography of the works on this question (*Annales de la Brasserie et de la Distillerie*, Ye. r XVIII, No. 2, pp. 22-27 Paris, Aug. 26, 1919) M. SCHOEN

in several laboratories in the United States during the war. It has been found that of all the kinds of yeast tried the *Saccharomyces ellipsoideus* No. 657 of the New York Natural History Museum collection gave the best results and transformed up to 25 % of the sugar fermented into glycerin. The reaction takes place in a sugary liquor containing 5 % of carbonate of soda and a little ammonium chloride. Attempts have been made to use for this purpose Porto Rico molasses, which are unsuitable for food.

The yeast is first grown in sterile grape must and, once the fermentation of that is done, 800 cc. of molasses diluted to a density of 1.085 are added. From the time the fermentation begins, the requisite quantity of carbonate of soda is added, or, at the start, 0.2 gm. Molasses solution and carbonate of soda are added successively, increasing the quantity of the latter continuously, then ammonium chloride: the last addition is one of 19 hectolitres of dilute molasses, 3.6 kg. of ammonium chloride, and carbonate of soda until there is 5 % of it.

The production of glycerin is greatest when fermentation takes place at 30° C. Only about half the glycerin formed can be extracted from the liquid fermented, or 5 to 6 kg. per 100 kg. of molasses. The process is of great theoretical interest, without making any comment on its industrial value.

1235 - **The Production and Conservation of Fats and Oils in the United States.** — BAILEY H. S. (Chemist in Charge, Oil, Fat, and Wax Laboratory, in collaboration with B. E. REUTER, Chief, Fats and Oil Division, U. S. Food Administration), in *United States Department of Agriculture, Bulletin No. 769, Contribution from the Bureau of Chemistry*, pp. 1-45. Washington, D. C., 1919.

Not only are fats and oils a necessary part of the food supply, but they also occupy an important place in the manufacture of certain munitions, in the lubrication of aircraft engines, and in the mixing of paints, varnishes, waterproofings, and like compounds.

Because the sum total of the world's supply of these substances is less than that of either of the other two basic food constituents, carbohydrates and proteins, a sudden drain, even though comparatively small, is quickly noticed. A great war soon creates such a drain, largely because of the imperative need for an enormous amount of nitroglycerin, one of the component parts of which is glycerin, obtained as a by-product in the manufacture of soap from certain oils and fats. In normal times the United States produces nearly 4 000 000 000 lb. of fats and oils, exclusive of butter fat, imports over 300 000 000 lb., exports about 1 000 000 000 lb. and consumes nearly 3 500 000 000 lb. Including the fat in the butter and cheese made in the United States, the total production is about 6 000 000 000 lb. or 30 000 000 tons.

states among other things that in certain wines, like those of Sauternes (produced by grapes affected with "noble" fermentation) the proportion of glycerin may reach 15 % of the sugar fermented. On the other hand, he states that by means of certain devices very simple at first sight, the course of alcoholic fermentation can be completely disarranged; the intermediary products of fermentation can be secured, or diverted from their eventual normal transformation, giving rise to new products which would not be formed at all under normal conditions of fermentation. (Ed.)

TABLE I. — *Production of Fats and Oils in the United States.*

Product	1912 Lb.	1917 Lb.
<i>Vegetable oils : —</i>		
Castor	5 145 000	6 188 000
Coconut	31 729 000	188 488 000
Coquito	—	(1916) 803 000
Cottonseed	1 435 401 000	1 343 074 000
Grape seed	320 000	607 000
Linseed	364 625 000	400 266 000
Mustard seed	360 000	1 098 000
Maize	72 832 000	118 021 000
Olive	966 000	963 000
Palm kernel	3 200 000	6 453 000
Peanut	454 000	50 287 000
Rapeseed	90 000	232 000
Sesame	—	304 000
Shea nut (<i>Bassia Parkii</i>)	—	81 000
Soy bean	—	42 074 000
Sunflower seed	—	5 000 ¹
All other vegetable oils	41 000	534 000
Total	1 966 613 000	2 159 335 000
<i>Animal and fish fats and oils : —</i>		
	Lb.	Lb.
Bone grease	29 267 000	30 668 000
Cod and cod liver oil	372 000	439 000
Garbage grease	29 812 000	56 229 000
Herring oil	1 888 000	1 637 000
Lard	731 164 000	873 798 000
Menhaden oil	40 787 000	19 627 000
Miscellaneous oils	2 639 000	2 575 000
Neat's foot oil	5 201 000	8 345 000
Neutral lard	51 414 000	5 712 000
Oleo stock	122 568 000	153 188 000
Packers' and renderer's grease	122 312 000	162 707 000
Sperm oil	3 832 000	3 285 000
Tallow	201 334 000	259 509 000
Whale oil	931 000	1 193 000
Wool grease and recovered grease	7 481 000	7 702 000
All other fish oils	815 000	2 837 000
Total	1 351 817 000	1 636 451 000
<i>Total production of fats and oils.</i>		
Vegetable oils	1 966 613 000	2 159 335 000
Animal fats	1 351 817 000	1 636 451 000
Total	3 318 430 000	3 795 786 000
Butter farm)	1 660 000 000	732 222 000
Butter (factory)	581 000 000	636 278 000
Total	2 241 000 000	1 369 500 000
Grand total	5 559 430 000	5 165 286 000

TABLE II. — *United States foreign trade in fats and oils.*

Product	1912 — Lb	1917 — Lb.
<i>Imports : —</i>		
Chinese nut oil	42 787 000	41 190 000
Coconut oil	46 720 000	163 091 000
Cottonseed oil	2 160 000	13 826 000
Linseed oil	2 135 000	633 000
Olive oil, edible.	43 460 000	51 055 000
Olive oil, inedible.	5 694 000	4 476 000
Palm oil	52 771 000	34 257 000
Palm kernel oil	27 681 000	306
Peanut oil	7 626 000	27 405 000
Rapeseed oil	10 266 000	10 132 000
Soy bean oil	24 959 000	264 926 000
Oleostearin	9 178 000	5 555 000
Cod and cod liver oil	21 727 000	16 618 000
All other fish oils	—	3 124 000
Total	297 164 000	636 288 306
<i>Exports :—</i>		
Chinese nut oil (tung).	80 000	244 000
Coconut oil.	358 000	1 830 000
Cottonseed oil	356 288 000	124 843 000
Linseed oil	3 151 000	10 724 000
Maize oil.	228 700 000	4 709 000
Olive oil, edible	59 000	436 000
Palm oil	112 000	31 000
Palm kernel oil.	75 000	167 000
Peanut oil	7 000	145 000
Soy bean oil	184 000	3 977 000
Fish oils (except whale).	9 375 000	895 000
Lard.	495 093 000	373 349 000
Lard, neutral.	57 556 000	9 395 000
Lard oil	1 224 000	1 911 000
Oleo oil	95 345 000	33 403 000
Stearin (animal)	1 524 000	8 375 000
Tallow	28 989 000	7 506 000
All other fish and animal oils	10 729 000	2 314 000
Total	1 083 019 000	584 254 000

Some rather interesting broad generalisations may be based on the foregoing tables.

1. The United States normally produces about six times as much fat as is exported, even if the quantity of fats and oils combined in other foods, such as condensed milk, meats, and grains, and in technical products are not considered.

2. While in the pre-war years the United States exported over three

times as much as were imported, in 1917 the imports were larger than the exports.

3. The production of the animal fats, exclusive of butter fat, equal to but 70 per cent. of the vegetable oil output of the United States in 1912, rose in 1917 to nearly 80 per cent. Including butter, in 1912 the quantity of animal fats was approximately twice as great as that of vegetable oils, while in 1917 the production of the two classes of fats and oils was nearly the same.

4. Among the vegetable oils, that made from cotton seed stands in a class by itself with respect to its production in the United States. In 1912, it constituted 73 per cent., and in 1917, when the cotton crop was unusually short, 61 per cent. of the total production. Next in importance in this class of oils is linseed, which in the United States is used entirely for technical purposes. Before the war, in 1912, and in 1917, after the United States, had begun to feel the effects of the war on its foreign commerce, linseed oil constituted about 19 per cent. of the total vegetable oil production. It will be noticed that the quantities of coconut oil, maize oil, peanut oil, and soy bean oil have increased very rapidly during the last five years. The amount of coconut oil made in 1917 was six times as much as that manufactured in 1912; the amount of maize oil was somewhat less than twice as great; and the peanut oil made in 1917 was over 100 times as much as that produced in 1912. Probably little or no soy bean oil was made in the United States in 1912, but in 1917 the oil mills turned out more than 42 000 000 lb.

5. Very little animal fat has been imported. Even when the fish oils and butter substitutes are included, the total annual importation in pre-war years was only about 28 000 000 lb. or a little less than 9 per cent. of the amount consumed. After the war began the annual importation increased about 2 000 000 lbs. While the importation of animal fats into the United States has not increased greatly during the last six years, the amount of some of the vegetable oils being imported has shown a remarkable increase. For instance, the importation of soy bean oil in 1917 was over ten times as great as in 1912, more than twice as much as the cottonseed oil exports. Similarly, in spite of the enormous increase in domestic production, the importation of peanut oil rose from 7 626 000 lb. in 1912, to 27 405 000 lb., in 1917.

During the recent Great War, the matter of maintaining an adequate supply of fats and oils became a very important factor. Although the allied nations were able to secure enough to meet their military and civil needs, Germany soon found herself seriously embarrassed by a lack of all fats. Had her Government heeded the advice of those experts who advocated the planting of oil-producing crops during the years of preparation for the war, such a situation probably would have been avoided, for vegetable oils are being used in ever-increasing amounts to supplement the animal fats and oils. Some, like cottonseed oil, make a satisfactory substitute for part at least of the animal fats in such products as lard, while some of the less well-known vegetable oils, like peanut and maize,

are rapidly growing in public favour as substitutes for olive oil, which has recently been very difficult to obtain. It has also been found possible to conserve the supply of linseed oil by using tung and similar oils in making paint, varnishes, and other technical products. It is believed that the manufacturer of vegetable oils could practice many more economies than he now does, thus eliminating certain sources of waste.

The recently devised hydrogenation process has made it possible to secure a very satisfactory lard compound, in which a vegetable oil replaces all of the often more expensive animal fat. By means of this same process, various fish oils now employed only for technical purposes may be rendered edible.

Conservation in food materials is still essential. To this end the small butcher and farmer are urged to trim the animals they slaughter closely to obtain all the fat possible for rendering as lard or tallow. The housewife, too, should be as economical as possible in her use of animal fats.

The question of recovering fatty matter from garbage and trade wastes is receiving much attention at this time, and it is probable that effective methods for doing this will soon be worked out.

1236 - French Colonial Production of Oils and Fats. — DIBOWSKY, J., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. V. No. 28, pp. 734-737. Paris, July 30, 1919.

Oils and fats, as is well known, have an economic rôle of prime importance. They are indispensable as food and no less so for the carrying on of industry, for machinery and for engines. Their influence on the conduct and result of the late world war was considerable, as the Allies did not lack for them, while the Central Empires were severely handicapped by shortage in these materials. This was so because the territory of each group of belligerents was incapable of providing even a small part of the needs for industry or for food and because colonial production played the most important part.

On the whole, the European production scarcely amounts to $\frac{1}{10}$ of the quantity produced, since over $\frac{2}{3}$ of the linseed production comes from outside Europe (518 000 tons from India, 475 000 tons from the United States, 331 000 tons from Canada and 883 000 tons from Argentina), and 1 224 000 tons of the world's production comes from India.

During the war the percentages of production among the belligerents were: Allies 86 %; Neutrals 9 %; Russia 4.5 %; Central Empires 0.5 %.

The preponderance of colonial production appears from the few figures given below, which refer to the world's production.

Cottonseed	8 268 000 metric tons
Linseed	2 916 000
Rapeseed	1 496 000
Palm kernels	312 000
Sesamun	260 000
Groundnuts	615 000
Copra	420 000
Palm oil	122 000
<i>Total</i>	<i>14 409 000 metric tons</i>

The resources of the French colonial empire are considerable in oils, and the production of these, which is already very high (France already occupies a foremost place among the nations which produce food oils and fats having copra as basis), can and should increase much further still.

1237 - Oil from the Candle-Nut Tree (*Aleurites triloba*); its Use in Painting. — LESPINAÏSE, in *Annales des Falsifications et des Fraudes*, Year XII, Nos. 127-128, pp. 152-153. Paris, May-June, 1919.

The writer, head of the Laboratory of the Hospital at Papeete, (Tahiti) states that in the French settlements in Oceania, whole valleys are covered with *Aleurites triloba* (candlenut-tree) which forms almost the sole vegetation. The possibility of using the oil from the nuts of this tree should not be lost sight of.

Formerly, these nuts were used for lighting purposes, hence the popular name of *A. triloba*. In the Marquesas Islands, the nuts used for lighting were mounted on pieces of stout stem. Now they are no longer made use of and there is no doubt that hundreds of tons of oil are lost every year.

100 kg. of nuts yield from 7 to 10 kg. of kernels, and 100 kg. of kernels yield, under a laboratory press, 40 kg. of oil, and when extracted with petroleum ether, 55 kg. After desiccation in the sun, the oil content of the kernels may be as much as 63.65 per cent.

The writer gives the physical and chemical constants of the oil from *Aleurites triloba*. Basing his opinion on these constants, he thinks that this oil could be used with advantage in soap-making (1) and as a substitute for the linseed oil mixed with paints. He made a fairly good soap from this oil, but it was inferior to that obtained from copra. The writer considers that the best means of employing the oil of *Aleurites triloba* is in the manufacture of oil-colours.

1238 - The Value of the Pericarps of *Garcinia Mangostana* L. in the Tanning Industry. — HEIM, F., MAHEU, J., and MATROD, L. in *Bulletin de l'Office Colonial*, Year XII, No. 136, pp. 259-264. 2 pl. Paris-Melun, April, 1919.

The pericarps of the fruits of *Garcinia Mangostana* L. (Guttiferales) are used for tanning and dyeing purposes by the natives of Cochin China. The leaves and bark of the same tree are used, according to PIERRE, for fixing the colours and rendering them more brilliant.

With a view to discovering whether this raw material was likely to be of interest to the French tanning industry, experiments were carried out upon this interesting waste product of an edible fruit grown in all tropical orchards. The samples used for the investigation were collected by the Agricultural Services of Cochin China, and sent by the Government of that Colony.

The writers give the details of their chemical and technological investigations. It appears that the pericarps of *G. Mangostana* are of no

(1) As regards the use of this oil in soap-making, see B., July-August-September, 1917, No. 997. (Ed.)

value as a source of dyes, but are rather rich in a tannin which can be absorbed by the powder of hides, that is to say, it is useful in tanning. It would, however be of no use to the French tanneries, for these pericarps only contain 13.61 per cent. of tannin, as against 14.59 per cent. of nontannins, and the tanning industry rejects all raw material containing more than 1 part of non-tannin substances (at the maximum) for every 2 parts of tannin substances.

1239 - **Textilose.** — BREITENSTEIN, A., in *La Revue de la Filature et du Tissage*, Year III, No. 15, pp. 168-170. Épinal, May-June, 1918.

A new industry is becoming established: — the manufacture of yarn and fabrics of paper, either alone or mixed with textile fibres.

The paper is moistened (it may be of advantage to add hygroscopic salts to the water used for this purpose) and cut up in strips which are made into round threads or into cords by spinning, twisting and winding.

In order to get stronger or finer threads, textile fibres, preferably cotton, are mixed with the paper. A carding machine placed in front of the paper machine deposits the fibre on the sheet of pulp and the two materials mix intimately. To accentuate the action of the fibre, the latter may be applied to both sides of the paper.

Yarns of "textilose" seem to have a sure future, especially for the making of packing sheets, carpeting and furniture stuffs, and even for some kinds of dress materials.

1240 - **Canadian Woods, Tonkin Rambos, and *Hibiscus cannabinus* for Paper Making.** — See Nos 1163-1144-1140 of this *Review*.

1241 - **Vegetable Ivory from French Africa: New Ways of Using this Product.** — See No. 1152 of this *Review*.

1242 - **Government Dairy Farms in Mesopotamia.** — HEIZER, O S, in *Commerce Reports*, No 98 n 323 Washington D C April 15, 1918

INDUSTRIES
DEPENDING
ON ANIMAL
PRODUCTS

The British military authorities have established model dairy farms at Basrah, Anara, Kut, Bagdad, Ramadi, Hillah, and Nasiriyah. These are managed by experts and the milk is treated under hygienic conditions. Each farm has been equipped with an up-to-date dairy plant and machinery and the whole dairy produce, consisting of milk, cream, and butter, is turned over to the military hospitals.

Large numbers of cattle have been imported from India and efforts are being made to improve and increase the herds in Mesopotamia.

The Department of Agriculture, which henceforth will control the dairy farms, has been very active in different directions. Various demonstration farms — poultry farms, wheat and cotton farms — have been established. New canals, irrigation channels, dams, reservoirs, and the reconstruction of similar works which have long fallen into disuse, have been undertaken.

- 1243 - **Straining Milk (1).** — KELLOG, E and GAMBLE, J. A., in *Farmers' Bulletin* 1019, *United States Department of Agriculture*, pp 14, 14 Figs. Washington, D. C., January, 1919.

Sediment in milk indicates carelessness in its production or handling. Sediment contaminates milk and makes it less salable. Most of the sediment in milk comes from the bodies of cows and consists of hairs, manure, bedding, etc.

Straining removes only the coarse particles of dirt and removes neither the bacteria nor the fine dirt. Straining improves the commercial quality of milk, but does not appreciably improve its healthfulness. The best system is to prevent, so far as possible, the entrance of dirt into milk. This can be done best by having clean cows in clean stables, milked with clean hands into clean, small-top pails.

Filter cloth and absorbent cotton are efficient materials for strainers. Cheesecloth and wire gauze are less effective. Straining cloths should be changed whenever they become soiled. They should be thoroughly washed and sterilized after using. Efficient sterilisation is accomplished by boiling or exposure to steam for at least five minutes.

The milking barn should be clean, and well lighted and ventilated. The stalls should be built with regard to the size of the cows. Droppings should fall in the manure gutter and the cows should have a clean, dry, well-bedded place on which to lie. Keep the cows groomed to remove loose hair and manure. Before milking wash the cows' udders and flanks and wipe with a damp cloth. Milk with clean, dry hands into a clean, sterilized, small-top pail. Remove the milk immediately to the milk house, where it should be strained and cooled at once. Keep milk tightly covered at all times. Protect clean utensils from flies and dust.

- 1244 - **Experiments in Distinguishing Between Cow's Milk and Buffalo's Milk in Egypt.** — TODD, CHARLES (*Director of the Laboratory of Public Health in Cairo*), in *Annales des Falsifications et des Fraudes*, Year XI, No. 125-126, pp. 82-85. Paris, March-April, 1919.

Although most of the milk sold retail in Egypt is buffalo's milk, a certain amount of cow's milk is also put on the market, and as the latter is much less rich in butter, it is necessary to have different standards by which to determine the fat content of these two products.

Messrs PAPEL and HOGAN have examined, in their laboratory, a large number of samples of cow's and of buffalo's milk, in Cairo, and the Department of Public Health has adopted the following standards (based upon their researches) for the two types of milk:—

Buffalo	—	butter per 100:	5	—	Extract freed from fat per 100 :	8.5
Cow	—	"	3	—	"	8.5

Lower figures are regarded as affording proof of adulteration.

(1) See also *R*, March, 1919, No. 371. (Ed.)

In order to apply these standards, it is necessary to know whether the sample is one of buffalo's or cow's milk, before any opinion can be given as to its purity (whether it has been skimmed, or watered). It is easy to distinguish between the two kinds of milk, on account of the yellow colour of the fatty matter in cow's milk, but owing to the samples often being mixed, it is frequently impossible to apply the standards. Any test which would show the presence of relatively small quantities of one milk in the other would be of great use, and experiments were made with this object.

As, with the exception of the fat content, there is no difference between the milks of the cow and the buffalo that can be determined by chemical analysis, or physical methods, a biological test seems the only possible resource, and the reaction of the precipitins appears to promise the best results. The experiments proved the following points :—

- 1) The injection of the cow with buffalo's milk produces the precipitins for buffalo's milk, and to a lesser degree, for goat's milk.
- 2) By treating with cow's milk the serum obtained, the precipitins for the cow and goat can be removed, leaving the serum that is specific for buffalo milk.
- 3) The original serum does not precipitate the blood serum of either the cow or buffalo, but is haemolytic as regards the red corpuscles of both animals ;
- 4) The antigen in the milk is soluble in dilute acetic acid, and is capable of being precipitated by the neutralisation of the solution.
- 5) The injection of cow's milk into the buffalo produces only traces of precipitin.

1245 - **Lactose, Fat, and Protein in Milk of Various Animals** (1). — TOLIN, O., DENIS, W. and MINOT, S. (Harvard Medical School, Boston), in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 3, pp. 349-352. Baltimore, March, 1919.

The results summarised in the annexed table were obtained by using, for the determination of the lactose, two methods which the authors devised and which they described in the *Journal of Biological Chemistry*, Vol. XXXIII, p. 521, 1918 ; for the determination of fat, the BABCOCK method for the milk of the larger animals and BLOORS' nephelometric method (which requires only 1.cc. of milk) for the milk of the smaller animals were used. Protein was calculated from the nitrogen content obtained by the KJELDAHL method.

(1) See *R. May*, 1918, No. 578 (*E.M.*)

Analyses of the milk of various animals.

	Lactose	Fat		Remarks
Woman	7.06%	—	1.39%	Average of results on milk from 87 normal women
Cow	4.51	—	—	Average of results on milk from 21 cows
Goat	1.7	2.4 %	2.14	Pure Saanen (Swiss) goat Milk taken 8 weeks after kidding
"	1.9	5.1	2.44	Grade 3/8 Anglo-Nubian goat Milk taken 4 1/2 months after kidding
"	5.16	1.2	3.42	Grade Anglo Nubian Goat (1/2) Milk taken 2 3/4 months after kidding
"	5.2	3.7	3.72	Common American Goat Milk taken 3 mos. after kidding
Sheep	5.4	2.0	3.00	Hampshire 4 yrs old Milk taken 2 1/2 months after delivery
* Mare	1.4	0.1	1.72	Average of results on 3 samples Foal 1/2 months old
Pigs	4.0	3.66	7.93	Milk taken 5 wks after delivery
Dog	2.6	10.0	10.60	Russian wolf hound Pup 3 days old
Cat	3.1	10.0	11.1	Average of results of 26 samples of milk from 4 cats
Rabbit	1.8	12.1	11.4	Average of results on 19 samples of milk from 6 rabbits

1246—The Non Protein Nitrogenous Constituents of Cow's Milk (1) DRETS, W., and MINOR A. S., in *The Journal of Biological Chemistry*, Vol. XXXVII, No. 3, pp. 353-366 March, 1919, and Vol. XXXVIII, No. 3, pp. 453-458 Baltimore, July, 1919

The qualitative composition of the non-protein nitrogenous constituents of milk (amino-acids, urea, creatin, creatinin, purin bodies and ammonia) has been known, to a certain extent at least, for many years, but on account of the lack of appropriate analytical methods, data are lacking on the amounts of these bodies present in milk either under normal or under pathological conditions. The authors have elaborated the analytical technique for the quantitative determination of some of these constituents. And, in this work, they present the results obtained by means of their methods on a considerable number of samples of cow's milk. The following are the maximum and minimum values respectively of each constituent, according to the table in which they are shown (quantities in mgm. per 100 cc. of milk):—Total nonprotein nitrogen 38.0 and 19.0—Urea nitrogen 20.0 and 5.2—Amino nitrogen 7.3 and 2.6—Uric acid 2.0 and 1.3—Preformed creatinin 1.5 and 1.0—Creatin 2.6 and 2.0. As will be seen, the content of these constituents varies enormously. The authors demonstrate that they are influenced by the nature of the foods, the content being increased by rations

(1) As regards milk protein, see R, June, 1918, No. 693; for milk cholesterol, see R, May, 1919, No. 645. (Ed.)

rich in protein substances and decreased by rations where these are wanting.

Colostrum has a much higher content in non-protein nitrogen, amino nitrogen and urea (2 hours after calving, 7.8 mg. and 28.6 mg. respectively per 100 cc. of colostrum). The content in these substances gradually diminishes and approaches normal values only on the fourth day after calving.

1247 - **On the Peroxydases of Milk.** — VIOLLE, H., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXIX, No. 5, pp. 248-250. Paris, August 4, 1919.

All writers on the subject are unanimous in regarding the presence of peroxydases in raw milk, and the absence of these substances in boiled milk, as matters of great importance.

From the author's experiments, it appears that: - 1) the reaction of the peroxydases is no criterion of the quality of the milk; wholesome milk may contain very few peroxydases, and the milk from diseased udders may be rich in these compounds; 2) a positive reaction proves that the milk is raw, but it is easy to obtain this reaction by adding to warmed milk fresh organic tissues, or liquids of animal or plant origin of various kinds and different composition.

1248 - **The Microscopic Examination of Milk in Laboratory Practice.** — FROST, W. D. and MOORE, G. D., in *Journal of Dairy Science*, Vol. II, No. 3, pp. 189-196. Baltimore. May, 1919.

The microscopic test for pasteurised milk has been described by FROST (1).

It has been applied to 260 of the routine milk samples analysed by the laboratories of the Chicago Health Department and has given excellent results. Investigation has shown that this method may be used to control pasteurised milk supplies with a high degree of accuracy and that it requires neither expensive equipment nor unusual skill and is not excessively time-consuming. According to these results, the positive test should indicate the following points: a properly pasteurised milk should show the nuclei of practically all of the leucocytes in compact masses and well stained, with the background lighter than the nuclei, except in the very thickest places. The leucocytes should be small and if the milk has been kept under proper conditions to prevent growth, the bacteria should not be stained at all or at least variably or indistinctly. The stain used is a 0.015 per cent. aqueous solution of methylene blue. Of 260 samples analysed, 213 were condemned by inspectors as insufficiently pasteurised and of these 14 could not be considered satisfactory on account of their high bacterial content.

(1) A microscopic test for pasteurised milk. *Journ. Amer. Med. Assoc.*, 1915, Vol. LXIV, pp. 821-2. Microscopic test for pasteurised milk. *Report of the Annual Convention of the International Milk Dealers' Association*, p. 74, 1916.

- 1249 - **The Effect of Corrosive Sublimate when Used in Dairies as a Preservative in Composite Samples of Milk for Analytical Purposes.** — JACKSON, H. C., in *Journal of Dairy Science*, Vol. II, No. 3, pp. 170-182, Baltimore, May, 1919.

The author, after passing rapidly in review the experiments made on this subject by POTTS, PATRICK, HILLS, NEWMAN, RONNENBERG, KRÜGER, BEVAN, LINDET, MAC CORNELL, GICLOT, WINDISCH, GIRARD and HUNZIKER, goes on to speak of his own researches with corrosive sublimate. He found that 0.5 gm. of HgCl_2 was sufficient to preserve from 150 to 300 cc. of composite samples of milk for at least 15 days.

In using Babcock's milk-fat test, he proved that the addition of 0.5 gm. to 1.5 gm. of mercuric chloride produced no alteration in the fat column, and gave rise to no inaccuracy in reading. The fact that some of the fat tests of composite samples present difficulties in reading on account of the irregular consistency of the fat column, therefore does not seem to be due to the use of corrosive sublimate as a preservative.

- 1250 - **Fly Pupae in Bottled Milk.** — RILEY, W. A., in *Journal of Dairy Science*, Vol. II No. 3, pp. 183-188, Baltimore, May, 1919.

The writer found in a quart bottle of certified milk, 30 pupae of *Drosophila ampelophila* attached to the glass. Dr. FERTICK mentioned a similar occurrence in 1913 in Budapest. The flies lay their eggs on the interior surface of empty bottles, and within less than a week, the pupae emerge, and attach themselves so firmly to the glass, that they are not removed, even when the bottles, on reaching the dairy, are put through the washing-machine. The writer insists upon the necessity of the returned bottles being washed in the dairy in an almost boiling solution of caustic soda, and urges consumers to wash their bottles as soon as they are empty, and to replace the cap.

- 1251 - **The Temperature of Solution of Butter Fat in Various Reagents.** — JOHNSTON, J. H., in *Journal of Dairy Science*, Vol. II, No. 2, pp. 130-132, Baltimore, March, 1919.

The author refers to the investigations of FRYER AND WESTON, who attribute to the hygroscopic nature of the acetic acid reagent and to the presence of free acids in the fat the discrepancies in the VALENTA test, and he also indicates the modifications recommended by these investigators and by PARKER for the acetic acid reagent.

The objections of these investigators to CRISMER's method are dealt with and the author remarks that in practice long experience has shown that absolute alcohol when kept in small well stoppered bottles gives constant results.

For butter fat the CRISMER number in most cases is 53° to 54° C., varying between 51° and 56° C. For margarine made chiefly from beef fat the CRISMER number is over 65° C., and made from vegetable fats the number is below 45° C. In butter fat, the presence of free fatty acid lowers the CRISMER number about 1.5° C for each per cent. of acidity calculated as oleic acid. This correction is necessary in the examination of old butters, but it may be disregarded in the case of fresh butter.

1252 - The Household Foam Test for Butter and Oleomargarine. — SOMMER, H. H., in *Journal of Dairy Science*, Vol. II, No. 2, pp. 142-144. Baltimore, March, 1919.

One of the household tests for distinguishing between butter, and oleomargarine and renovated butter is the "foam test". Butter when heated boils quietly with an abundant production of foam, whereas oleomargarine and renovated butter sputter and do not produce so much foam. The author investigated the cause of this difference, which is the subject of this article, and he came to the following conclusions: —

1) Fats will foam if the water that they contain is held finely divided in suspension; they sputter if the water gathers in droplets.

2) The curd in butter is finely divided and holds small particles of water in suspension; therefore butter foams.

3) The curd in oleomargarine and renovated butter is coarse and allows the water to gather in droplets; therefore oleomargarine and renovated butter sputter.

4) Certain "butter substitutes" that contain finely divided substances capable of holding water may foam as well as butter.

1253 - National and State Marks adopted in the United States for Butter and Cheese. — MORTENSEN, M., in *Journal of Dairy Science*, Vol. I., No. 2, pp. 383-399. Baltimore, January, 1914.

This subject was dealt with by the author at the 12th Annual Conference of the American Dairy Science Association held at Columbus, Ohio, on October 22, 1917. After full discussion the proposals brought forward by the reporter were approved; the latter, speaking of trade marks in use in Minnesota, Michigan and Iowa, took the opportunity to advocate a normal national mark, "National Standard Product". The Report deals also with regulations in force on this subject in the province of Saskatchewan (Canada), in New Zealand, Denmark and the Netherlands.

The Conference passed the following resolutions:—

1) To dissolve the Committee for guarantee Marks, state or national, and nominate a new Commission for the standardisation of American butter.

2) The new Commission should encourage the foundation of Stations charged with the grading of butter in the different States and should stimulate co-operative action on the part of butter factories, with the object of engaging an expert to control the quality of the production from a given group of butter factories.

3) The Commission should try to gain the good will and co-operation of butter merchants, so as to encourage the above mentioned movement.

4) The Commission must act in concert with the other similar Institutions, such as the National Buttermakers' Association, the Association of Dairy and Food Commissioners, the various State organisations, and the Dairy Industry Division of the Bureau of Markets, Washington.

5) The Commission should also collaborate with the above-mentioned Institutions, so as to establish a commercial standard for American butter, taking due account of the fact that in Canada and in most European countries the commercial dairy butter standard is fixed at 94, a limit which should in no case be lowered for American butter.

1254 - **The Ripening of Sausages.** — CÉSARI, M. P., in *Comptes rendus de l'Académie des Sciences*, Vol. 168, No. 15, p. 802, Paris, April 14, 1919.

The special aroma characterising sausages arises in the paste during the drying period. This maturation is accompanied by a slight peptonising of the meat, and a diminution in the muscular glycogene. It is certainly due to the micro-organisms that develop in large numbers in the paste during the drying process. Many microbes and yeasts are always present. The bacteria which are always present (*yellow Staphylococcus*, white *Staphylococcus*, *Diplococcus griseus non liquefaciens*, *B. coli* and *B. proteus*), cannot be regarded as the cause of the sausage ripening, because they are always concerned in the putrefaction of meat, and those which have proteolytic properties, produce, at the expense of the albuminoids, substances with an unpleasant odour. Everything points to yeasts being the active agents in the maturation process.

These yeasts make their appearance upon the meat shortly after the salt has been added; they are met with again on the sausage paste and, associated with *Staphylococcus* in the particles forming the "sausage flower" (which is a sign of the sausages having been well made). They are very easily isolated on pieces of carrot by means of the so-called elimination method.

Sausage yeasts differ in their characters from the other yeasts that have hitherto been described. The different lines isolated by the author belong to 3 distinct, but very nearly-related, species. According to GUILIERMOND's classification, they should be placed in the family of the *Saccharomycetes*, genus *Zygosaccharomyces*. The author is, however, of opinion that from their origin, homogeneity, and special characters, they ought to form a separate family, if not a distinct genus. The part played by these yeasts in the ripening of the sausage is easily explained by their moderate proteolytic power, and their property of giving rise to aromatic products.

The natural ripening of sausages could be improved by sowing the yeasts in question on the sausage-paste. These micro-organisms could be selected, in order to obtain the most delicate and agreeable flavours. From the hygienic point of view, such an addition of yeasts would have the advantage of hindering, by their rapid growth and inimical action, the development of the micro-organisms of putrefaction, which are inevitably present, and cannot but exercise a deleterious effect.

1255 - **The Micro-organisms of Tinned Peas.** — MARRE, F., in *L'Industrie française de la Conserve* Year V, No. 25, pp. 117-120, Paris, June, 1919.

It is necessary to cultivate the very numerous microorganisms found in tinned peas, in order to know whether they are alive, for their mere presence has no special signification. Once the fact of their being alive has been determined, it is important to define them accurately, as they may be :-

1) *Yeasts*, which attack the sugar of the peas, transforming it into alcohol, with the liberation of carbon dioxide.

2) *R. coli*, the bacterium of putrefaction. This attacks the sugar

and the albuminoid substances, liberating hydrogen and sulphuretted hydrogen. In order to kill these most dangerous bacteria, it is enough to heat them for at least 30 minutes, at a temperature of from 115°-120° C.

3) *Microbes of lactic fermentation*. These occur less frequently than the preceding micro-organisms, since they are killed at 60°-65 C., a temperature which is always exceeded in the sterilisation processes.

4) *B. subtilis*: if after having been heated to 115°-120° C., the peas are not sterile, we may conclude that we have to do with anaerobic micro-organisms belonging to the group of *B. subtilis*. They are very dangerous, for owing to their slow development, it is difficult to determine their presence in a living condition. In order to sterilise tins containing *B. subtilis*, they must be tyndalised twice at 120° C. for 45 minutes.

5) *B. acescens*: under this generic name is included a group of microorganisms, which have not yet been completely studied. They do not liberate any gases and hence don't budge the tins, but they turn the contents acid, without, however, causing turbidity. Though it is difficult to ascertain their presence, there is an efficient means of control which consists in sterilising the surface of the tin with hot water, then perforating the bottom with a sterile cutter, and introducing litmus paper into the resulting opening; if the paper turns red *B. acescens* is present; if blue it is sound. Though not certain, tyndalisation twice at 120° C. for 30 minutes apparently kills organisms belonging to this group.

6) *Microbes producing turbidity*. These micro-organisms have not yet been studied. They make the liquid surrounding them turbid, without producing any liberation of gas, and at the beginning, at any rate, do not alter the peas in any visible manner.

1256 - **Stability of Olive Oil**. — HOLLAND, E. B., REED, J. C., and BUCKLEY, J. P. Jr. (Massachusetts Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XIII, No. 7. pp. 353-366, 1 fig., bibliography of 9 publications. Washington, May 1, 1918.

In a previous article (HOLLAND, E. B., *Stability of Butter-fat Samples*. Massachusetts Agricultural Experiment Station, 22nd Annual Report, 1st Part, pp. 132-135, 1910), one of the authors reported the effect of air, light and moisture at room temperature on butter-fat. The experiment lasted a year and a half, but proved faulty, in that a fat which is solid and opaque at ordinary temperature, was a poor medium for measuring such changes which evidently were not uniform throughout the mass, but greatest at the surface.

The authors therefore were of opinion, that another series of tests under more definite conditions should be made, and finally selected olive oil for the purpose.

The experiment lasted for six years, and was planned to demonstrate the effect upon the oil of air, light and moisture, singly, and in combination.

The practical deductions, which are of importance from the point of view of keeping this oil, are as follows :—

From an economic standpoint, air causes a slow destruction of colour in olive oil, and produced rancidity and the decomposition of the unsaturated acids. Light causes an active destruction of colour, and a slow production of rancidity. The combined action of air and light causes the most active destruction of colour, the active destruction of unsaturated acids, a rapid production of rancidity, and a slow, but marked, production of free fatty acids.

Moisture causes the formation of precipitate, a turbid oil, and free fatty acids. The combined action of air and moisture practically duplicates the effect of air + moisture and the combined action of light and moisture duplicates the effect of both these factors.

Air-light-moisture exceeded the effect of air-light plus that of moisture in the amount of free fatty acids produced ; otherwise it was essentially the same.

In order to preserve olive oils in their natural state, it is necessary to exclude air, light and moisture as completely as possible, particularly the combined action of air and light, which has proved to be exceedingly destructive.

1257 — Commercial Preservation of Eggs by Cold Storage. — JENKIN, M. E. (Assistant Bacteriologist, under the direction of PENNINGTON, M. D. (Chief, Food Research Laboratory), in *U S Department of Agriculture, Bulletin No. 775*, pp. 35, 8 Figs, Washington, D C, June 3, 1919

Although a number of publications discuss the losses in eggs which follow the routine course of marketing without the intervention of cold storage, comparatively few data, showing the changes and losses in different grades of eggs handled according to commercial usages during various holding periods in cold storage, are available. This investigation was made primarily to determine the efficiency of the preservation of commercial eggs by cold storage. The following phases of the problem were studied : — 1) The relative keeping quality of fresh, heated, sound, dirty, and cracked eggs. 2) The relation of the month of storage to preservation. 3) Efficiency of the commercial grading of eggs for cold storage. 4) Analysis of bad eggs developing in commercially packed eggs during storage. 5) Relation of care in initial grading to the development of bad eggs during storage. — 6) Rate of evaporation of moisture from eggs. 7) Rate of absorption of moisture by case and packing. 8) Physical and chemical changes in eggs during storage. 9) Absorption of foreign flavours during storage.

The results are summarised as follows : —

Practically all the eggs used in these investigations were produced in the Middle West and all were stored in warehouses located in the East.

Freshly laid eggs with clean whole shells that have not been wet show a negligible loss in bad eggs, even after 10 to 11 months in storage.

Imperfections in commercial handling, grading, and marketing pre-

vicious to storage are mainly responsible for the bad eggs developing in commercial eggs during storage.

The preservation in the shell of undergrade eggs, such as dirty, cracked, leaking, heated, and stale eggs, should not be attempted. If not marketed for prompt consumption, the contents should be removed under proper conditions and frozen. The frozen product will keep for a year or more, whereas there would be a marked deterioration in quality if the eggs were stored in the shell.

Spring eggs on the market are usually fresher than summer eggs, and for that reason keep better in storage. Most of the eggs stored are produced in the spring.

The commercial selection by inspection and clicking of clean eggs with sound shells from current receipts is inefficient. Commercial packages of spring firsts ready to be taken to the storage rooms showed an average of 17.5 cracked eggs and 1 leaking egg to the case. Dirty and stained eggs were often included. Owing to the high quality of spring stock, there was usually less than 1 bad egg to the case initially present as found by candling.

Candling is a much more accurate method for the selection of eggs for storage. By this method eggs can be graded according to quality, cracked eggs can be more accurately detected and eliminated, and bad eggs can be found and rejected. Cases of spring firsts graded by candling did not average more than 3 cracked eggs per case when ready for storage.

Spring eggs prepared for storage by commercial sorting showed after 7 to 11 months' storage an average total loss of 18.5 bad eggs per case, 13.5 of which were detected by candling and 5 by breaking. Corresponding cases of eggs graded for storage by candling showed after a similar period in storage 4 bad eggs per case as found by candling and 3 additional by breaking. The value of the good eggs saved by the careful candling of eggs for storage more than offsets the extra cost of preparation.

Of the average of 18.5 bad eggs per case present in the commercially graded spring packages after long storing, 9 were due to direct spoilage of damaged eggs or to their contamination of neighbouring eggs by moulding. The deterioration of the balance of the eggs with whole shells was no doubt due to deleterious pre-storage conditions, such as dirty, wet, stained, or washed shells, or heated shell content. Careful grading of eggs for storage very largely eliminates the loss due to damaged, dirty, or stained shells.

The rate of evaporation of moisture from eggs was remarkably uniform during the storage period, and averaged from 3 to 4 ounces per case per month in the different storage rooms under observation.

The moisture from the eggs is condensed on the brine pipes, and absorbed by the air, case, and fillers. Most of the absorption of moisture by the egg package occurs during the first few months in storage. In these studies the gain in weight of individual cases with the accompanying cushions, fillers, and flats varied from 11.5 to 14 ounces during a storage period of 10.8 months.

In the cold-storage rooms under observation there was a gradual rise in the humidity with the advance of the season.

Eggs that are fresh when stored show after storing an increased air-space and often a tinge of yellow in the white. The yolk membrane weakened, but commercial separation into white and yolk is usually easily accomplished, even after 11 months' storage.

The percentage of ammoniacal nitrogen in eggs increases during storage, the rise being the fastest during the early part of the storage period. The amount of ammoniacal nitrogen in eggs is a good index of chemical deterioration.

During commercial holding in cold storage the eggs develop a characteristic cold-storage taste, which is usually present after the seventh month and becomes stronger the longer the eggs are stored. The evidence seems to indicate that the flavour is due to the absorption of the odors from the surrounding environment, particularly from the strawboard fillers in which the eggs are packed.

1258 - **Preparation of Strawberries for Market.**—MORE, C. T. and TRUAX, H. B. in *Farmers' Bulletin* 970, U. S. Department of Agriculture, Pp. 27, 18 Figs. Washington, D. C., May, 1918

This bulletin describes efficient methods of preparing strawberries for market. The phases discussed include importance of good handling, the labour problem, picking, grading, commercial strawberry grades recommended, packing, packing sheds, shipping packages, standardisation of package, branding and marking, inspection and loading sheds, and loading cars. The conclusions arrived at are summarised as follows. —

The best of marketing facilities can not overcome the handicap of inefficient picking, grading, and packing methods. The unsatisfactory condition and grade of strawberries frequently found on the markets indicate a great need for standardisation and better handling methods. The first step in marketing is to engage an adequate supply of competent dependable labour, before the picking season begins. It is necessary, also, to provide competent supervision for the pickers before they are sent into the berry field.

The proper stage of ripeness for harvesting strawberries depends upon the variety and the distance to be shipped, but it varies from about three-fourths coloured to a full-red color. Growers and shippers who trace occasional shipments to market can determine whether the fruit is being delivered to dealers in the best possible conditions as to ripeness.

Strawberries properly picked are pinched off the vine with a stem about three-eighths to one-half inch long, and carefully placed, not snatched off and tossed or thrown into the boxes. Many pickers require instructions as to the proper method of picking.

Trays for carrying the berry boxes into the field are best made light in weight, substantial, medium in size, and built so that the boxes fit into them snugly.

Long exposure to the sun, rain, or dust, either in the field, at the pack-

ing shed, or while being hauled to the loading station, will injure the picked strawberries.

Under most conditions the removal of undesirable berries from field-run stock will be as much hand grading as will be found practicable. Avoidance of unnecessary handling is advisable. Whether or not the berries have been graded, the filled boxes should be classified as to quality before they are placed in crates for shipment. Depending upon conditions, strawberries may be graded either in the field by the pickers or in the packing shed by special labour. Packing shed grading is usually the most practicable and efficient method.

Fixed, uniform strawberry grades are very desirable as a guide and basis for the use of growers in preparing their crop for the market, of buyers in the purchase of fruit, and of inspectors at the point of shipment or destination. The important factors to be considered in strawberry grade are size and quality.

Boxes should contain a uniform grade of berries and be filled so that they are neither slack nor so full that the berries are likely to be crushed. It is advisable to place the fruit under refrigeration as soon as possible after it is packed.

Careful supervision at the packing shed is of vital importance ; so also are the location, plan, and cost of the packing shed.

The crates in most general use for strawberries contain 24 or 32 dry quart boxes. Crates holding 16, 20, 24, 30, or 32 pint boxes, and 16, 48 or 60 quart boxes also are used. New, clean, attractive, strongly made crates are best, because the selling price of berries is affected when they are offered for sale in damaged or unattractive packages.

Demand for standardisation of the capacity of containers for berries and other small fruits has been insistent. Since November 1, 1917, it is not lawful to use any boxes or other containers for interstate shipment except those having a capacity of a dry half pint, dry pint, dry quart, or some multiple of a dry quart, for small fruits, berries, and vegetables. Even in local or intrastate marketing it is likely to be detrimental to growers and shippers as well as to dealers and consumers if other than these standard boxes are used.

Growers and shipping associations that wish to build a reputation for well standardised grades of berries may use brand labels pasted on the ends of crates to good advantage. The Federal Food and Drugs Act requires that all crates of berries be marked with a statement of the quantity of the contents. If the variety, the grade, and the grower's name and address are also neatly marked, the prospective buyer will have confidence in the product.

A rigid system of inspection at the loading stations is a prerequisite to the permanent success of shipping associations.

Most of the strawberry-shipping sections would be benefited greatly by adequate car loading and inspection sheds.

For safe carrying, crates must be located in the car compactly, with ample provision for the circulation of cold air, and braced firmly to avoid shifting and damage in transit.

1259 -- The Exportation of "Vary Lava" Rice from Madagascar. — *Bulletin de l'Office Colonial*, Year XII, No. 137, p. 378. Paris-Melun, May, 1919.

With the objects of encouraging the still restricted cultivation of "vary lava", one of the best varieties of rice, and of encouraging the industrial treatment of this product, which, when properly prepared, is a first class article, the Governor-General of Madagascar has decided to authorise the exportation of this rice to France, on condition that it be hulled, cleaned, and polished, and be of the quality known as "Carolina rice".

DISEASES OF PLANTS

GENERAL INFORMATION

LEGISLATIVE
AND ADMINISTRATIVE
MEASURES FOR
PLANT
PROTECTION

1260 - Decree of the Italian Minister of Agriculture Regulating the Trade in Various Plants and Parts of Plants, Attacked by Certain Plant and Animal Parasites in Italy. — *Gazzetta ufficiale del Regno d'Italia*, Year 1919, No. 239, p. 2999, Rome, October 8, 1919

Under date of September, 28, 1919, the Minister of Agriculture, seeing the necessity of preventing the further diffusion in Italy of plant diseases at present limited to certain areas has published the following decree:—

Art. 1. — The export is prohibited of: a) cuttings, or rooted cuttings of vines from districts declared to be infected with "bramble-leaf" (*arricciamento* " or "roncet")

b) Chestnut trees, and chestnut earth from districts declared to be infected with "ink disease" (*Blepharospora cambijora*).

On the proposal of the Delegate of the Phytopathological Service, and by the decree of the Minister of Agriculture, the boundaries of the infected area shall be determined, and the destructive, or curative, measures to be adopted according to the cases (art. 22 of the regulation of March 12, 1916, No. 723).

Art. 2. The export of the plants mentioned in Art. 1. from the areas that are declared to be infected can be permitted by the Minister after the said plants have been inspected by a Delegate of the Phytopathological Service. The latter shall give the sender a certificate of immunity which must accompany the consignment. The inspection expenses are defrayed by the sender and must be equal to the travelling indemnities paid by the Administration to that officer.

Art. 3. — It is prohibited to import into Sicily and Sardinia from any place whatsoever living citrus trees, and other trees which may be infested with *Ceroplastes sinensis*. The Minister may, in certain cases, permit the importation into Sicily and Sardinia of the host-plants of *C. sinensis*, provided that the consignment be accompanied by a certificate of immunity granted at the time of dispatch, in conformity with Art. 2.

Art. 4. — In conformity with Arts. 2 and 22 of the above mentioned regulation, the Minister may make compulsory the control of the diseases and parasites mentioned in Arts. 1 and 3 of this decree, as well as the control of the following parasites:—

a) The scale-insect of citrus fruits (*Chrysomphalus dictyospermi*).

- b) The woolly aphid of the apple-tree (*Schizoneura lanigera*).
- c) The "worm" of the pistachio (*Trogocarpus ballestrerii*, syn. *Megastigmus ballestrerii*).

d) Pear-leaf cluster cups (*Gymnosporangium Sabinae*).

e) *Lupa* of the bean (*Orobancha crenata*).

Art. 5. — The Delegates of the Phytopathological service are required to sequester plants, or portions of plants, offered for sale or supplied for propagating purposes, if they are infected with any of the diseases enumerated in Arts 1, 3 and 4 of the present decree, or with any of the following diseases : —

a) "Canker", "gummosis", or "root-rot" of woody plants.

b) Canada poplar canker (*Dothichiza populea*); the osier weevil (*Cryptorhynchus lapathi*).

c) "Rot" of rhizomes or off-set shoots of asparagus (*Zophia rhizophila*).

d) Any species of *Cuscuta*.

e) Scale-insects: *Icerya purchasi*, *Parlatoria zizyphi*, *Aonidiella aurantii*, *A. inopinata*, *Diaspis pentagona*.

Art. 6. — The Delegate of the Phytopathological Service, after having satisfied himself of the presence in a nursery-garden, shop, or store-house of any one of the diseases mentioned in Arts. 1, 3, 4, 5, shall inform the persons interested of the measures of cure, or of disinfection, to be used for a prescribed length of time.

If the person interested does not disinfest, or carry out the treatment for the time prescribed, the Delegate of the phytopathological service shall proceed according to Art. 22 of the regulation already mentioned.

Art. 7. — The certificate of immunity may not be granted for the respective species of plants in nurseries, horticultural establishments or the gardens where plants are grown for sale, if the presence there is certified of any one of the diseases enumerated in Arts. 1, 3, 4 and 5 of the present decree.

The prohibition shall be withdrawn when it has been ascertained that the disease has disappeared in consequence of the treatment prescribed by Art. 6 of the present decree.

Art. 8. — The ministerial decree of December 8, 1916, prohibiting trade in plants attacked by certain diseases is abrogated (1).

1261 — **Law of September 25, 1919, Instituting Compulsory Syndicates for Protection Against Locusts in Algeria.** — *Journal officiel de la République française*, Year LI, No 263, p 10610. Paris, September 28, 1919.

Art. 1. — In consequence of the derogation of the Law of December 24, 1888, dealing with the destruction of insects, fungi and other plants injurious to agriculture, the destruction of locusts in Algeria shall be carried out in accordance with the provisions of the present law.

Art. 2. — The prefects shall prescribe, by means of special orders sub-

(1) R., March, 1917, No. 288. (Ed)

mitted to the approval of the Governor-General, the measures to be taken for the destruction of locusts in Algeria, and the time at which this destruction should be carried out.

The measures prescribed by these orders are executed in each Commune by a Syndicate, to which all agriculturists must perforce belong. The measures are carried out upon all land which is free of buildings, whether cultivated or not by the commune, as well as upon similar land that is the property of the State, the Department, the Communes, and of public or private establishments.

Art. 3. — All expenses incurred in the execution of the measures prescribed by *Art. 2* are defrayed by the Budget of Algeria and classed under the head of necessary expenses.

At the end of the season, each Syndicate shall draw up a statement of its expenditure and send it, together with all necessary explanations, to the Prefect, who after examining the statement, shall forward it without delay to the Governor-General.

Art. 4. — In the case of the measures not being carried out, and of unjustifiable delay, the Prefect shall *ex officio* provide for the execution of the prescribed measures. In this case, the expenses shall remain a charge upon the members of the defaulting Syndicate, and shall be apportioned to each of them in the proportion of the tax on the net returns of the agricultural estate upon which it is imposed. In no case may the penalty exceed the amount of the tax on the net returns of the farm.

These expenses are recovered in the same manner as direct taxes, by means of executory mandates issued by the Prefect.

Art. 5. — The Governor-General shall fix each year the mixed and native Communes in full work in which the provisions of the present law shall be carried out.

A regulation of public administration shall determine the conditions of the application of the present law.

1262 — **The Law of August 14, 1919, Amending the Algerian Legislation Relating to the Control of Phylloxera.** — *Journal officiel de la République française*, Year LI, No 220, p. 8770 Paris, August 15, 1919.

Art. 1. — All vines no matter what their origin may be, can be cultivated and transported throughout the Colony without any restriction, except in certain special cases, for which provision has been made in *Arts. 3* and *4* as under.

Hence the following decrees and laws are abrogated : —

1) The decree of July 18, 1880, rendering applicable to Algeria the laws of July 15, 1878, and of August 2, 1879, relating to the measures to be taken for checking the spread of Phylloxera and Doryphora in France.

2) The laws of March 21, 1883, July 28, 1886, and March 23, 1889 relating to the measures to be taken in order to insure the protection of the vineyards of Algeria.

3) The decree of July 17, 1884, dealing with the measures to be taken for preventing the introduction of Phylloxera into Algeria, the decree

of December 30, 1893, amending the preceding decree, and authorising the entrance of fresh fruit and vegetables into Algeria, and the decree of March 10, 1884, authorising the introduction, under certain conditions, into Algeria of trees, shrubs and plants of other kinds than the vine.

Art. 2. — The importation into Algeria of vines and all other species of plants, plant residues, fresh fruit and vegetables, bags, covers and packing material, or of props and poles that have already been used, of all plant fertilisers, soils, vegetable mould, and manures, as well as of all other substances, or objects, use may constitute a danger from the point of view of the infection of the crops, is regulated by the orders of the Governor-General, which have been passed in the Government Council and approved by the Minister of Agriculture.

The Governor-General may, on the advice of the Minister of Agriculture, forbid the introduction into Algeria or order the destruction of any plant likely to serve as a means of transport of insects, fungi, or other plants, which are injurious to agriculture, as well as of any objects which might be dangerous in this respect.

He can order the destruction without compensation at the places of entrance of plants, or produce, that has been exposed to contagion and, in short, take all the measures that the fear of the entrance of an epiphytic disease shall render necessary.

Art. 3. — The right of free cultivation and free trade re-established by Art. 1. does not apply to communes in which half plus one of the vine-growers who are entered on the registers as owners of property which is not occupied by buildings, and possess two-thirds of the land planted with vines, shall have declared themselves against its application.

The special measures to be applied to these communes as regards vine cultivation, importation and trade, shall be regulated by a order of the Governor-General passed in the Government Council.

Art. 4. — The wine-growers of the communes enjoying this special treatment shall be permitted to profit by the freedom conferred by the present Law by virtue of an order of the Governor-General which shall be passed on the request of half plus one of the vine-growers who are entered on the registers as owners of property which is not occupied by buildings, and who possess two-thirds of the land planted with vines.

Art. 5. — An Order of the Governor-General shall set forth the formalities to be observed by the persons interested in order that they may benefit by the regulations contained in Art. 3 (§1) and Art 4.

Art. 6. — In the Communes mentioned in Art. 3, the control of Phylloxera shall remain in the hands of the Communal Syndicate for Protection, the constitution of which is compulsory, and which shall include all the vinegrowers of the communes.

The Syndicate shall be able to benefit from the financial assistance of the Colony to the extent of a sum not exceeding the sums produced by the annual tax levied by the Syndicate itself. The Colony shall, in like manner provide the Syndicates thus instituted with all the necessary materials and

chemicals, and place at their disposal the staff of the service of crop protection, who shall direct the execution of the work.

Art. 7. — The unappropriated funds of the Departmental Syndicates against Phylloxera existing at the time of the promulgation of the present Law shall, if they are large enough, form the reserve funds of the Syndicate instituted in the communes mentioned in Art. 3, until they reach the sum represented by the taxes paid the previous year by the syndicated vine-growers. The surplus shall be employed for the formation of reconstruction experiment fields, in such a manner, and under such conditions, as shall be set forth by an Order of the Governor-General.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1263 — *The Metagenetic Stage of Leptosphaeria Tritici, an Ascomycete Injurious to Wheat.* — DURRILL, L. W., in *Science*, New Series, Vol. 1, No. 1289, pp. 252-253. Lancaster, Pa., September 12, 1919.

GENERAL

In the State of Iowa, United States, a species of what seemed to be an *Ascochyta* has frequently been found on dead straw. Recently, while cultivating *Leptosphaeria tritici*, the relationship existing between these two forms was revealed.

The pycnidial fruiting bodies grow side by side with the perithecia of *L. tritici* on dead wheat straw in the spring, and are difficult to distinguish from them, both being dark, submerged, and of the same size, though the ostioles of the perithecia are more protruding. The pycnidia are filled with guttulate stylospores, usually divided by a transverse septum, and approximately $12-20 \times 3.5 - 4 \mu$; their size, shape and manner of production suggest *Ascochyta graminicola* as described by FRANK. Single spore cultures of the ascospores of *L. tritici* obtained by the Hansen method of isolation, produce on potato agar, and on sterile straw, pycnidia and stylospores like those found growing on the wheat plant together with the perithecia of *L. tritici*.

1264 — *Hybrid Direct Bearers Resistant to Cryptogamic Diseases and to Phylloxera in Alsace.* — See No. 1128 of this Review.

RESISTANT
PLANTS

1265 — *Formaldehyde as a Means of Controlling Wheat Scab (Gibberella Saubinetii) and other Seed-Borne Diseases of Cereals.* — MELHUS, J. E., and RHODES, L., in *Science*, New Series, Vol. 2, No. 1279, p. 21. Lancaster, Pa., July 4, 1919.

MEANS
OF PREVENTION
AND CONTROL

Experiments carried out at the Iowa Experiment Station, United States, for the purpose of ascertaining the effect of hot formaldehyde upon *Gibberella Saubinetii*, proved that placing wheat in a formaldehyde solution at 50° C., such as is used in the case of potato scab (*Oospora scabiei*), was either ineffective in killing the fungus or destructive to the viability of the seed.

In order to overcome these difficulties, the grain was suspended just above the formaldehyde solution (1 part in 240 parts of water), and the temperature raised to 98-99°C., the time of exposure being reduced to 20 seconds.

Under these conditions, all the fungi in, or on, the seed were killed, and in the majority of cases the bacteria were also eliminated. This momentary treatment did not injure the germinating capacity of the seed. The fungoid flora of wheat seeds was destroyed in 20 seconds, while the germinating capacity of the grain was not injured in 40 second, and only slightly impaired in 50 seconds. It is believed that this methods can be made practical for the control of *G. Saubinetii* and other seed-borne diseases of cereals.

1266 - **The Comparative Efficacy of Ordinary Bordeaux Mixtures and of Bordeaux Mixtures Containing Casein in Protecting Grapes.** -- VERMOREL and DANTONY, in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 2nd Half-Year, 1919, Vol. CLXIX, No. 9 (Sept 1st 1919). pp 430 440. Paris, 1919.

In order to protect grapes from mildew, treatment must be applied as soon as flowering is over. Later, it is practically impossible to reach them, for the fruit is covered by the leaves. To ensure the protection of the grapes, it is necessary for the Bordeaux mixture to adhere to them until the vintage, therefore it must have a strong adhesive property, and at the same time be easily dissolved by rain.

The addition of casein to ordinary Bordeaux mixtures (with a lime basis) allows of these results being attained, as is shown by the following experiments.

Having sprayed the even rows of a vineyard on June 11, 1919, with ordinary Bordeaux mixture, and the odd rows with the same mixture to which 50 gm. of casein per hectolitre had been added, the authors carefully removed every day, beginning with June 12, 50 bunches, and at once brushed of the powder adhering to them. The powder thus obtained was treated with 200 cc. charged with carbon dioxide under perfectly constant conditions of pressure and temperature. It was left in contact with the water for 5 minutes, and mechanically kept in suspension in the solvent.

The insoluble portion was immediately separated by decanting and filtering, and then treated with nitric acid. The two cupric solutions obtained were subsequently electrolysed. The many figures resulting from this work are given, for the sake of convenience, in a special paper.

The authors found that 24 hours after spraying, the amount of metallic copper borne by 100 bunches of grapes amounted to 990 mgm. in the case of ordinary Bordeaux mixture, and 560 mgm. in that of Bordeaux mixture to which casein had been added. The latter wets the grapes, and covers them with a thin continuous coating, the excess falling on the leaves, or the soil. Ordinary Bordeaux mixture, on the other hand, forms rather large drops which dry on the grapes and deposit more copper, but the latter is less evenly distributed.

In any case, the amount of copper lost by ordinary Bordeaux mixture is in course of time much larger than that lost by Bordeaux mixture with an admixture of casein.

From the 7th day, the Bordeaux mixture containing casein maintained the first place, and time only confirmed its superiority.

After 15 days, 128 mgm. of copper were obtained from the ordinary Bordeaux mixture, and 206 mgm. from the Bordeaux mixture with casein. After 1 month, 48 mgm. were obtained from the ordinary mixture and 155 mgm. from the mixture containing casein that is to say 3 times as much.

After 45 days, 20 mgm. were obtained from the ordinary mixture, and 140 mgm. from the mixture with casein, that is to say 7 times as much.

The figures obtained for the portion soluble in water charged with carbon dioxide were no less conclusive; from the 3rd day, the mixture containing casein is more soluble than the other, and this superiority becomes more accentuated: it is twice as soluble on the 25th day and three times as soluble after 45 days.

Casein is therefore a most efficacious adjunct which should in future always be put into all Bordeaux mixtures (with a lime basis) for the following reasons. —

1) It insures "wetting" and hence the uniform distribution of the protecting copper over the whole surface of the portions treated.

2) The solubility of the copper is not lessened, nor is the latter removed by rain or storms, which is of great importance, as the grapes being now buried among the leaves, could not be reached by any spraying.

1267 - **Patents for the Control of Diseases and Pests of Plants** — See No. 1225 of this Review.

1268 - ***Bacterium translucens* var. *undulosum* n. var. Injurious to Wheat in the United States.** — SMITH, E F., JONES, L. R. and REDDY, C S., in *Science, New Series*, Vol I., No. 1280, p 48, Lancaster, Pa., July 11, 1919,

DISEASES
OF VARIOUS
CROPS

The continued prevalence in the United States of the disease known as black chaff of wheat makes it desirable to have a scientific Latin name for the bacterial organism causing it. This micro-organism resembles *Bacterium translucens*, the cause of the bacterial blight of barley (1). In cross-inoculations on the leaves of seedling plants the barley micro-organism on wheat has proved either non-infectious, or has produced small non-typical lesions.

On the other hand, inoculation experiments have shown that the wheat micro-organism is practically as pathogenic on barley as it is on wheat, and the lesions so produced on barley are indistinguishable from those produced by the barley micro-organism itself. Therefore, the authors suggest that for the present at least, the wheat micro-organism be distinguished as *Bacterium translucens* var. *undulosum* n. var. with, in general, the characteristics already given for the species. *Bact. translucens* var. *undulosum* produces yellow or translucent stripes on leaves, water-soaked or black stripes on culms, and longitudinal, more or less sunken stripes or spots on the glumes. In moist weather, the bacteria often ooze to the surface of the diseased spots or stripes as tiny drops that become yellowish on drying. The bacterium attacks also the kernels, especially at the base, causing them to be shrunk and honey-combed with bacterial pockets. Even when the

(1) See R., May, 1918, No. 593. (Ed.)

not only are "misses" (failures in germination) likely to occur, but the soil will probably be seriously infected with the skin spot fungus.

1271 - **Remarks on *Urophlyctis Alalfae* on Lucerne in France** (1). — FROM and LASNIER, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 22 (meetings of June 11 and 18, 1919) pp. 642-644. Paris, 1919.

This disease, known in France as "tumeurs marbrées" was observed for the first time there in 1916, in the neighbourhood of Villepreux (Seine-et-Oise); subsequently, it was noticed near Dreux (Eure-et-Loire). The authors are of opinion that the malady is more wide-spread than is supposed and that it is probably one of the causes of the premature dying off of many crops of lucerne.

They have found little tumours produced by *Urophlyctis Alalfae*, not only in the crown region, or on the underground parts of lucerne, but also on the stalks and leaves when the plants first begin to grow in the spring (2).

Infection experiments are now being carried out, which if they succeed, should furnish some data as to the means of preventing or controlling the disease.

1272 **The Leaf-Spot Diseases of Lucerne and Red Clover Caused by the Discomycetes *Pseudopeziza Medicaginis* and *Pseudopez. Trifolii***. — JONES, FRED REUEL, in *United States Department of Agriculture, Bulletin* 759. pp. 1-38, 5 figs, 3 pl Washington, D C., June 19, 1919.

One of the most important if not the most important of the foliage diseases attacking lucerne is the leaf-spot caused by the fungus *Pseudopeziza medicaginis* (Lib) Sacc. A similar, but less serious, leaf-spot of red clover is produced by the fungus *Pseudopeziza trifolii* (Biv.-Bern) Fuck. The morphological differences between these fungi are so slight, that doubt has frequently been expressed whether they are not identical. Several conflicting opinions as to their life-histories are found in mycological literature.

Pseudopez. medicaginis on lucerne, and *Pseudopez. trifolii* on red clover, have been obtained and studied in pure culture by the writer. Efforts to cross these fungi from one host to the other have not been successful. Morphological, as well as physiological, differences have been found, which in the author's opinion justify retaining the fungi as distinct species. None of the imperfect fungi that have been regarded as metagenetic stages of

(1) See R., Nov. 1916, No. 1233. (Ed)

(2) Other observers have also reported the formation of these little tubercles on the aerial parts of the host plant. Cfr. T. FERRARIS, "I parassiti vegetali delle piante coltivate od utili" and Edition 2 Milan, H. Hoepli, 1915, p. 140. (Ed).

(3) In 1905-1906, SALMON made inoculation experiments in order to demonstrate that the resting spores of *U. Alalfae* when liberated and dispersed in the ground, are able at once to produce this disease upon lucerne. He also wished to discover by these experiments whether the fungus can attack other plants such as *Beta vulgaris* and *Solanum tuberosum*. Cfr. G. MASSEE, "Diseases of Cultivated Plants and Trees", London, Duckworth and Co., 1910, pp. 93-94. (Ed)

the two discomycetes have been found to be related. Apparently, no other spore form than the ascospore occurs in nature.

Infection is produced by the direct penetration of the germinating ascospores through the cuticle and epidermal cell wall of the leaf; the mycelium developing into a small stroma about the point of entry produces an apothecium in about a fortnight.

The fungus lives over winter on dead leaves which escape decay and ascospores produced in the spring furnish the source of the new infection.

By means of surface sterilisation of the seed unsuccessful attempts have been made to exclude the disease from fields of lucerne which are at a distance from other crops of this leguminosa. Evidently in these experiments at least, the fungus was not carried on the surface of the seed, and was probably not transported by the seed at all. The demonstration of the source of infection in such fields still furnishes an interesting problem.

1273 - *Bacterium angulatum* n. sp., Injurious to Tobacco in the State of Virginia. — FROMME, F. D. and MURRAY, T. J. in *Journal of Agricultural Research*, Vol. XVI, No. 8, pp. 219-228, 3 pl. Washington, D. C., 1919.

In 1917, a serious tobacco disease was reported from many parts of the State of Virginia (Halifax, Campbell, Charlotte, Mecklenburgh, Pittsylvania, Henry and Patrick Counties).

On the leaves of the affected plants, especially the top and middle leaves, were seen small spots; these were either scattered over the entire surface or crowded in irregular groups. The spots occurred on both surfaces of the leaves and were characterised by their irregularly angular shape, whence the name, angular leaf-spot of tobacco.

During the first ten days of August, almost all the plants in many of the fields were attacked, and in some, 50 per cent. of the crop was estimated by the growers to be unfit for harvest. From careful calculations based on data obtained from a demonstration field at the substation of Charlotte Court House it was found that the total loss in weight was 20 per cent. and the loss in grade approximately 40 per cent.

By means of numerous experiments the authors succeeded in isolating, in pure culture, a bacterium from the surface of the infected leaves.

This micro-organism they regard as the cause of the disease, and describe at length as a new species (*B. angulatum*) in the article analysed.

The malady has apparently been present in Virginia to some extent for several years, and may have a wide distribution.

Rainfall is an important aid to infection, especially when it is coupled with a temperature below the normal. The development of the organism within the tobacco leaf is apparently dependent to a marked degree on those predisposing factors which promote a rapid vigorous growth of the host-plant. The fungus seems to enter the leaves through the stomata.

1274 - *Sphaerotheca Mors-Uvae*, an Erysiphacea Injurious to *Ribes Grosularia*, *R. Rubrum* and *R. aureum*, Observed for the First Time in Côte-d'Or, France. — VERCIER, J., in *Le Progrès Agricole et Viticole* (Edition of Est-Centre), Year XL, Vol. LXX, No. 35, pp. 207-209, 2 figs. Montpellier, August 31, 1919.

American Gooseberry Mildew (*Sphaerotheca Mors-Uvae*) -- which had

already for some years been observed on the gooseberry (*Ribes Grossularia*) in nurseries at Orleans (1), and in the neighbourhood of Paris and Honfleur — was found in July, 1919, in Côte-d'Or on *Ribes Grossularia*, and also, though rarely on the red currant, *R. rubrum*, as well as on *R. aureum*. The injury done to the gooseberries by this parasite would not cause any serious apprehension to the growers (since as a rule, only a few bushes in each garden are attacked), were it not for the danger of its spreading to the red currants (*R. rubrum*) and black currants (*R. nigrum*), which are very important crops in this district, and the fear of its extending to other departments.

The author suggests "gooseberry grey" (*gris du groseillier*) as a suitable popular name for the disease, on account of the greyish hue assumed by the infected fruit. It is necessary that the evolution of the malady should be carefully studied, and every effort made to check it. This must be done by adopting the measures of control usual in such cases, and by forbidding the transport, or sale, of fruit, or young plants, coming from gardens which are infected or suspected of being infected with *Sphaerotheca Mors-Uvae*.

1275 - **Diseases of Roses in Trinidad, Antilles.** — RORER, J. B. in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVIII, Part. 1, pp. 29-31, 1 pl. Port of Spain, May 26, 1919.

A great deal of damage is annually caused to rose-gardens in Trinidad by several diseases which are briefly described by the author.

Three of these infections are very common wherever roses are grown, and are due to the fungi *Diplocarpon Rosae* Wolf, *Cercospora rosicola* Pass., and *Sphaerotheca pannosa* Lév.

Various fungicides have been used in the control of these diseases, but the best results have been obtained by dusting the plants with a mixture consisting of 1 lb. of arsenate of lead and 9 lb. of flowers of sulphur.

The rose-trees in Trinidad are also attacked in the region of the stem by two other diseases which, so far as the author knows, have not been reported from other countries. The most serious of these is caused by the parasitic alga *Cephaleuros virescens* and is met with on roses only in fairly damp situations, where it kills the whole plant.

When rose-bushes are badly affected with this disease, the only remedy is to cut them back very severely, and as they make new growth, to spray continually with Bordeaux mixture. In damp places, 15 or 20 applications a year would be necessary to protect the roses from this alga.

The second malady, which has been observed occasionally, is due to a species of *Stilbum*. It can be controlled by cutting out and burning the infected stems.

1276 - ***Cytospora* sp., a Deuteromycete Injurious to Apple trees in Illinois, United States.** — STEVENS, F. L. in *University of Illinois, Agricultural Experiment Station, Bulletin* 217, pp. 367-379 15 figs. 1 coloured plate, Urbana, Illinois, 1919.

At Altona, in Illinois, some young apple-trees coming originally from a New York nursery were attacked, during the spring of 1918, by a species

(1) See R., February, 1914, No 183. (Ed.)

of canker, which seemed to be of a kind likely before long to do serious damage.

A small apple-tree with a trunk of about 2 cm. in diameter, was found to be infected with canker. The latter extended 22 cm. up the trunk, completely surrounding it for the greater part of this distance, although it was 2 or 3 cm. higher or lower on one side of the tree than on the other. There was no abrasion, or wound to betray the place where the infection had begun. The canker was almost completely tan-coloured; towards one end however, it was darker and had a purplish or bronze shade, while at the other extremity, this coloration was wholly wanting.

The diseased tissues were clearly marked off from the healthy ones. On removing the bark, a black transverse line of about 1 mm. in width appeared to separate the affected from the unaffected tissues. Very probably, at this point the canker was in a resting condition, and not in the act of developing further. At the other end of the canker, there was no division between the healthy and the diseased tissues which gradually merged one into another, and there was no external dark, purplish band.

Over the whole area occupied by the canker were scattered small, black, conical pustules, which microscopic investigation enabled the writer to identify as the plurilocular stromae of a *Cytospora*. A pure culture of the fungus was easily obtained and grown for several months on different media. Laboratory inoculation experiments carried out with pure cultures on the branches of the apple and other rosaceae, quickly reproduced the disease with its natural characteristics. The examination of all the cultures failed to reveal the ascospore stage of the fungus. Several *Cytospora* have been referred with more or less likelihood to the genus *Valsa*. The author mentions 36 species of *Valsa* and 57 species of *Cytospora*, and forms resembling *Cytospora*, as causing cankers on plants belonging to the family of the *Rosaceae*.

Although the characters of the fungus under discussion resemble those of the *Cytospora* regarded as being the pycnidial form of *V. leucostoma*, the author is of opinion that it would be wise to wait before making a definite decision in the matter, and to defer selecting a specific name for this parasite.

1277 - *Phytophthora Faberi*, a *Peronospora* Causing Coconut Bud Rot in the Philippines (1). — REINKING, O. A. in *The Philippine Journal of Science*, Vol. XIV, No. 1, pp. 131-151, 3 pl. Manila, January, 1919.

In the Philippine Islands, enormous losses are occasioned every year by coconut bud rot, a disease attacking the terminal bud of the tree, and which is especially prevalent in the Provinces of Laguna, Tayabas, Pangasinan and Zamboanga. It is most severe in very humid sections, and in

(1) See R., Dec., 1910, pp. 407-410; R., July, 1911, No. 2163; R., Aug.-Sept.-Oct., 1911, No. 2692; R., March, 1912, No. 598; R., Dec., 1912, Nos. 1686 and 1698; R., Jan., 1913, No. 40; R., May, 1913, No. 609; R., Oct., 1914, No. 961; R., Jan., 1915, No. 1; R., Jan., 1916, No. 116. (Ed.).

thickly planted groves, both of which conditions are found on the slopes of Mt. Banakao. Field studies show that this disease may spread very rapidly during favourable weather. A micro-organism similar to *Bacillus coli* (Ischerich) Mig. and other saprophytic bacteria are associated with the disease. Under certain conditions, such as weakness engendered in the host plant by severe injury, the above-mentioned micro-organism and *B. coli* isolated from man, or horse, may in inoculation experiments produce coconut bud rot.

The results of about 300 inoculation experiments carried out by the author have demonstrated that, while the bacteria are always present and are a factor in destroying the weakened tissues, they cannot account for the outbreak of the disease, or for its prevalence and rapid spread.

Phytophthora Faberi Maubl. isolated from cacao, produces a typical bud rot of coconut seedlings and of mature coconut trees.

A fungus isolated from a typical field case of coconut bud rot produced in all inoculated seedlings a typical infection.

Phyt. Faberi isolated from a field case of coconut bud rot produced disease in coconut seedlings, cacao fruit, *Hevea brasiliensis* seedlings, and the fruit of *Carica Papaya*.

The same species of fungus isolated from cacao fruit produced disease in coconut seedlings and mature trees, cacao fruit and stem, *Hevea* seedlings, and mature trees and the fruit of *Carica Papaya*.

A morphological and taxonomic study of the organism isolated from coconut has proved that it is *Phytophthora Faberi* Maubl. as described by ROSENBAUM.

From these researches, it can be stated with certainty that *Phyt. Faberi* causes coconut bud rot; bacteria apparently in the majority of cases always play a secondary part; they are only a factor in destroying the weakened tissues.

The peronospora in question can develop rapidly, if the conditions are favourable, as a saprophyte on dead portion of coconut, cacao, and papaya.

Coconut trees, when once severely infected, never recover. The mode of growth of these palms, and the nature of the disease make it impossible to cure trees already badly affected. Systematic inspection, condemning and burning all diseased coconut trees, as carried on by the Philippine Board of Agriculture, should be continued.

All parts of diseased trees must be burned, otherwise the fungus will live as a saprophyte on dead matter, and then spread to healthy trees.

Clean cultivation ought to be practised in all the groves.

Under no circumstances should coconuts be interplanted with cacao, or papaya.

If coconuts are planted near diseased *Hevea*, precaution should be taken to prevent the spread of the disease. Trees in new coconut groves must be planted 10 metres apart, each way. This spacing is one of the most satisfactory means of control against bud rot, and at the same time tends to give the highest production of nuts.

1278 - Observations on the *Bacterium Micrococcus Populi*, Destructive to *Populus monilifera* var. *angulata* in France. — REGNIER, R. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 2nd Half-Year, 1919. Vol. CLXIX, No. 2 (July 15, 1919), pp. 85-88. Paris, 1919.

In 1906, G. DELACROIX described, under the name of "bacterial canker of the poplar", a very serious disease of *Populus monilifera* var. *angulata*, which he attributed to a new species of bacterium, *Micrococcus Populi*.

The author's investigations were begun in 1913, and were chiefly directed to the study of the evolution of this canker, the extent of its ravages and the agents by which it is spread. The results of these researches enabled him to state that, under natural conditions, the phenomena described by DELACROIX did not always occur.

Doubtless this difference of interpretation is to be explained by the fact that the writer largely employed experimental methods, instead of confining himself mainly to observation.

Canker attacks equally the branches and stems of young poplars, and the trunks of older trees. Two methods of infection occur: — 1) the parasite is introduced through a deep wound or lesion due to an insect or some other traumatic agent; when this occurs, the characteristic swellings described by DELACROIX are produced; 2) there is no apparent lesion, or at any rate, no deep wound; in this case, the disease passes through a certain number of phases, which can arbitrarily be reduced to the five described by the author.

From observations made in the field, two facts have been proved: canker, under whatever form it presents itself, is harmful to the tree attacked; the younger the tree is, however, the more injurious is the disease. Canker in large trees is only serious because they become centres of infection.

The author's last experiments were directed to discovering the agents that spread the disease, and show how important a part is played by insects. DELACROIX had already mentioned, in this connection, *Saperda populnea*, *Sesia* spp., various microlepidoptera, one of these being *Gypsonoma aceriana*, and finally, the rhynchote *Idiocerus populi*, of which the author proposes shortly to give the life-history.

Preventive measures are as follows: — (1) the choice of cuttings and, if possible, their disinfection; (2) making nurseries far from the centres of infection; (3) the regular elimination and burning of all diseased portions; (4) the destruction of all parasites of the poplar, which are carriers of the disease.

In the author's opinion, however, the most important thing is to find out what varieties of poplar are most resistant to canker. In 1914, many nursery-gardeners of the Valley of the Oise were devoting their attention to the solution of this problem.

As regards the diffusion of the disease, it appears that it has been known in the valley of the Oise since about 1880. It is said to have been introduced there by means of trees brought from the valley of the Ourcq, where it was very prevalent. Canker is also met with in the valleys of the Somme, the Aisne, and the Grand-Morin. It is a regular scourge in the Oise valley and other adjacent valleys (Verse and Ailette), from north of Chauny as far as the north-west border of the forest of Laigue.

Contrary to what DELACROIX has stated, plantations situated in damp valleys are as severely attacked as those growing in a quickly-drying soil.

1279 - *Gloeosporium limetticolum*, a *Melanconia* Injurious to *Citrus Aurantifolia* in Trinidad. — RORER, J. B., in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVIII, part 1, pp. 1-2, 1 pl. Port-of-Spain, 1919.

During July and August, 1918, there occurred throughout Trinidad, a severe outbreak of "wither-tip", a disease of lime-trees which is due to *Gloeosporium limetticolum* Clausen. This malady, although hitherto it has not been very prevalent in the island, is one of the commonest and most destructive diseases of limes.

The attacks of the fungus generally show on the tips and edges of the very young leaves, but they also affect the leaf stalk, at the point where the leaf joins the stem, or any point in the very young shoots.

The first sign of infection is indicated by a somewhat water-soaked appearance. If the weather is not very damp, this characteristic is not so pronounced, but the attacked part is light green in colour at first, and then brown. In all cases, the affected shoots wither up, whence the popular name of the disease. When the large young leaves are attacked, they often become curled and distorted, and the infected areas drop out, or become cracked, so that the leaf is punctured with holes. Apparently only young growing leaves and young shoots can be attacked by the fungus; leaves and shoots that have become hardened and matured are quite immune to the disease.

In addition to the leaves and tender shoots, the flowers and young fruit are very susceptible to attack. If the flowers are infected, they fall without setting fruit. The diseased fruits show a rough scaly appearance, and become cracked; they generally fall from the trees in two or three weeks.

After the fruits are half-grown, they seem to be immune to further attack. Full-grown fruits after having fallen to the ground may, however, be attacked through wounds.

If possible all the dead wood and diseased leaves should be collected and burnt during the dry season, and as soon as the trees begin to make their new growth after the rains begin, they should be thoroughly sprayed with Bordeaux mixture to which resin has been added to increase its adhesive property. After the first application has been made, the trees ought to be watched very carefully, in order to see whether the new growth is becoming infected. If infections are found, it is advisable to make another application of Bordeaux mixture. The number of sprayings that are necessary naturally depend upon the climatic conditions throughout the growing period.

WEEDS AND PARASITIC FLOWERING PLANTS.

1280 - The "Luo-binh" (*Eichhornia speciosa*) as a Water-Pest. — See No. 1199 of this *Review*.

[1278-1280]

INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1281 - *Coccobacillus Acridiorum* in the Control of *Schistocerca tatarica* in Morocco (1). — VELU, H., in *Bulletin de la Société de Pathologie exotique*, Vol. XII, No. 7, pp. 362-364. Paris, 1919.

MEANS
OF PREVENTION
AND CONTROL

The results obtained in Morocco during the third season of experiments in controlling *Schistocerca tatarica* (*S. peregrina*) by means of *Coccobacillus Acridiorum* show that, although the destruction of this insect by the use of bacterial cultures is very interesting from the experimental point of view, it cannot be regarded, at least for the present, as a practical measure.

In fact, it is evident, that in order to obtain positive results cheaply it is necessary to adopt some drastic means that will totally destroy all these insects.

So far, Herelle's method, like all the others, has failed to fulfil these requirements and hence, all the methods of defence which consist in destroying *Schistocerca* are nothing but a delusion.

As regards the biological method in particular, it should be added that the habits of the insects, the short duration of their larval stage, their limited susceptibility, the variations in their powers of resistance, the uncertain action of the virus, etc., all concur in rendering its application extremely difficult.

In the opinion of the author, the best measures to adopt are as follows:—

1) the destruction of all the locusts, from the moment of the arrival of the invading swarms from the south; all methods of accomplishing this are good, but they should be carried out at night; it is advisable to insure the destruction of the pests by means of a supreme effort on the part of the State, as the destruction of one locust means the suppression of 500-1000 of them; 2) protective measures due to private initiative, the efforts of landowners, Agricultural Syndicates, and Provident Societies. Destruction is useless when the invasion assumes large proportions. On spots covered by locusts there are, on an average, about 500 in the third and fourth stages to a square metre, and the total volume of these 500 insects is one litre; the volume of the larvae accumulated on a hectare is therefore 10 cu. metres and on a sq. km², 1000 cu. metres

What are the 70, 80, or 90 cu. metres destroyed at great expense and toil through out a whole district, in comparison to these 1000 cu. metres? It is very clear, that their number is negligible as compared with the vast number of the surviving insects. The natives contend, and not without reason, that the campaign against the locusts chiefly tends to break up the columns of the invaders, and thereby increase the damage done by them.

According to a legend, in former days, freedom from these pests was obtained by their total destruction in the Souss.

1282 - **Pathogenic Yeast Forms Found in the Blood of the Italian Cricket (*Calliptamus italicus*) in France.** — HOLLANDE, A. CH., in *Comptes rendus des séances de l'Académie des sciences*, Vol. CLXVIII, No. 26 (June 30, 1919), p. 1341-1344. Paris, 1919.

In the neighbourhood of the village of Gresse (altitude 1200 m.) in Isère, during September and October, 1918, the author found a large number of pathogenic yeast forms in the blood of *Calliptamus italicus* L. (*Caloptenus italicus* Burm.).

Normally the blood of this cricket is clear and of a yellow colour; where, however, these micro-organisms are present, it assumes a milky, and sometimes a yellowish hue. The infected individuals, when kept in captivity in metal cages, unlike the healthy control specimens, died very soon, although they were supplied with abundance of food.

The author was able to reproduce the disease without any difficulty, by injecting blood rich in these yeast forms into the blood of healthy crickets. The latter died in 5 to 7 days, and their blood contained a large number of the yeast micro-organism. The leucocytes destroy but few of the latter. The author found that many of the *Calliptamus* died 20 to 30 days after ingesting the parasites, but since the blood of the control individuals, though it was normal at the time of experiment, contained the same parasites after the same lapse of time, it is impossible to assert that the infection had been artificially introduced through the mouth.

Of all the orthoptera living in the places where the *Calliptamus* infected with these parasites was found, only one, a specimen of *Psophus stridulus* L., was discovered by the author to have yeast forms in its blood. The infected blood of *Calliptamus* when injected into healthy *Psophus* individuals, transmits the disease to them. The injection of the parasites into the blood of other orthoptera has no effect as the yeast forms are rapidly destroyed by their phagocytes.

1283 - **Observations on *Massospora cicadina*, a Mucedinea Parasitic on the Rhynohote *Cicada septemdecim* in Columbia, United States.** — SPEARE, A. T. in *Science*, New Series, Vol. I, No. 1253, pp. 116-117, Lancaster, Pa., August 1, 1919.

Massospora cicadina Peck was extremely prevalent about Washington, D. C., during the recent re-appearance of the tenth brood of *Cicada septemdecim* L. (periodical cicada). It was first collected in the conidial stage of development on May 31, or about ten days after the first emergence of the insect in this locality. Until June 7, however, it was not abundant (it being possible to collect only a dozen or so infected cicadas in an afternoon); during this period only the conidial form of the fungus was found. On June 10, however, — after a wet period of a few days — the fungus appeared in the resting spore condition, and after this date it became increasingly prevalent until from 5 to 9 out of every 10 adult males collected showed the resting spores of the fungus in some stage of development. On the other hand, infected insects showing conidia of *Massospora* were rarely found.

It appears from the observations made hitherto that the conidia and resting spores are not formed simultaneously on the same insect, and infected individuals bearing only conidia present a somewhat different general

appearance from those individuals in which resting spores exclusively are produced.

In the conidial stage of development, the fungus is usually exposed to view, owing to the sloughing off of several of the posterior abdominal segments of the host's body as a white or pale cream-coloured, somewhat coherent mass, which is found to arise, in the male hosts at least, from a cushion-like substratum forming a more or less complete septum extending across the entire body cavity. In front of this septum, the abdominal cavity is empty.

In the resting spore condition, the fungus mass, in the males, in the early stages at least, is likewise confined to the posterior portion of the abdomen, and is at first white, then sulphur yellow, and finally greenish brown, or brown in colour. It is only slightly coherent. While the fungus in this stage of development seems also to be confined to the genitalia of the host, there is apparently no septum formed, and at maturity the resting spores scatter about the entire body cavity. The resting spores, which are extremely uniform in size, are remarkably ornamented, and at maturity form a dust-like mass that is freed from the insect by the disintegration of the intersegmental membranes of the abdomen.

In the few infested females examined by the writer, the fungus mass filled nearly the entire body cavity.

As noted by previous writers, many infected cicadas were found still alive and actively flying about with but a portion of the abdomen remaining, the entire posterior portion having sloughed off, leaving the conidia, or resting spores, of the fungus exposed in such a way, that every movement of the host served to scatter them.

1284 — **The Pathogenic Action of *Bacillus hoplosternus* on Some Common Insects.** — PAILLOT, A, in *Annales de l'Institut Pasteur*, Vol. XXXIII, No. 6, pp 403-419, 8 figs. Paris, June 1919.

Bacillus hoplosternus (Paillot) was found only once in 1916, near Lyons, in the blood of a diseased cockchafer in association with *B. Melolonthae non liquefaciens* β. The cockchafer is, however, much attacked by this parasite. After describing the morphology of *B. hoplosternus* and the characters of artificial cultures of this micro-organism, the author gives an account of his inoculation experiments. In the latter, he inoculates the caterpillars of *Lymantria dispar*, *Vanessa urtica*, *Euproctis chrysorrhoea*, *Malacosoma neustria*, *Chelonia carya* (= *Arctia carya*) and adult specimens of *Melolontha vulgaris* and *Rhinotrogus (Amphimallus) solstitialis* with an emulsion of a culture of the bacillus.

Of all the insects thus experimented upon, the larvae of *Lymantria* alone offered any resistance to the multiplication of *B. hoplosternus* in their blood. Generally speaking, these larvae showed little susceptibility to inoculation with entomophytic microbic parasites, the only exception being in the case of coccobacilli. During the beginning of the outbreak of the disease, few infected caterpillars are found; subsequently, the microbic parasites are more frequently met with among the weak and late individuals, and cases of immunity are rarer.

- 1285 — **The Effect of Heat and Drought upon *Conchylis ambiguella*, in France.** — FEYTAUD, J., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. V, No. 25, pp. 689-696. Paris, July 9, 1919.

For 10 consecutive years without interruption, the author has closely followed the life-cycle of the cochylis (*Conchylis ambiguella* Hb.) in the same vineyard in Gironde, near Lespère, and on the same vine ("Cabernet-franc").

The results of his investigations show that atmospheric conditions during the summer have a great influence upon the multiplication of this micro-lepidopteron. In cool, damp summers, like those of 1909, 1910 and 1913 individuals of the second generation became very numerous.

On the other hand, hot dry summers, such as those of 1911 and 1918, were characterised by a great reduction in the numbers of the second generation.

All stages of cochylis may fall victims to a hot dry summer which destroys: 1) the fully developed larvae of the first generation; 2) the adults; 3) the eggs; 4) the young larvae of the second generation.

- 1286 — **Parasitic Diseases of the Pine Bombyx *Thaumetopoea (Cnethocampa) pityocampa*, in France.** — DUFRENOY, J. in *Comptes rendus des séances de l'Académie des Sciences*, First Half-year, 1919, Vol. XLXVIII, No. 26 (June 30, 1919), pp. 1345-1346. Paris, 1919.

The larvae of *Thaumetopoea (Cnethocampa) pityocampa* are attacked at Arcachon (Landes) by two parasitic tachinids, by *Bacterium Pityocampae*, *Streptococcus*, *Beauveria globulifera*, *Beauveria* sp., *Penicillium* sp., and *Spicaria larinosa*.

- 1287 — ***Botrytis Bassiana* (the Silk-Worm "Muscardine") in the Control of the Pine Bombyx (*Thaumetopoea [Cnethocampa] pityocampa*).** — GHIRLANDA C., in *Il Collivatore*, Year LXV, No. 21, pp. 329-423. Casale Monferrato, July 30, 1919.

The investigations of Prof. L. PIGORINI at Brusegana (Padua) (as well as subsequent experiments by the author) having proved that *Botrytis Bassiana*, the cause of the "muscardine" of the silkworm, is a natural enemy destroying the larvae of *Thaumetopoea (Cnethocampa) pityocampa*, the author takes the opportunity of drawing attention to the possibility of carrying out experiments on a large scale for the purpose of propagating the fungus in zones where the macrolepidopterous pest is most common.

Experiments made also at the Royal Sericultural Station of Padua have shown, that the "muscardine" can grow on various media. In order, however, to obtain speedily and as easily as possible, a pure culture of this fungus free from the other microbic forms usually accompanying it recourse must be had to media with an acid reaction. This is shown by the fact that *Botrytis* flourishes in the blood of the silkworm of which the acid content is very high.

It would not be difficult to prepare a cheap cultural medium in order to obtain the required material. For this purpose, relatively large Petri dishes could be used, into which as soon as the fungus has reached the complete stage of spore formation some inert powder could be placed (diatom earth, tale, etc.), in order to get homogeneous mixture of the fungus and

the powder. The infecting material thus being ready, it can be sprayed at the right time and by mean of ordinary bellows sprayers upon the leaves of the plants infected with the pest. By taking advantage of favourable currents of air, the mixture could be made to reach the nests of the caterpillars.

The most suitable time for the dissemination of the *Botrytis* conidia would, in the author's opinion, be towards the end of August or the beginning of September, for at this season, the largest number of larvae make their appearance. In this manner, the larvae would be attacked before they emigrated in search of food, and the action of the fungus would be much more rapid and deadly, because the caterpillars are then very small.

The operation, which should be carried out by a competent and expert staff, ought preferably to be performed at night, for it is at this time that the larvae leaving their nests can most directly be reached. Moonlight nights should be chosen, or should there be no moon acetylene lamps can be used. It must not be supposed, that this treatment is useless in the daytime, but in spraying by day, care ought to be taken to direct the spray upon the nests of the insect so that the caterpillars on coming out are easily covered with the powder, and thus infected.

1288 - *Pyrethrum Powder and Other Plant Insecticides.* — See 1151 of this Review

1289 - *Pyrausta nubilalis*, a Parasite of Maize in the Toulouse District. —

RIVES, L., in *Le Progrès Agricole et Viticole*, Year XXXVI, Vol. LXXI, No. 26, pp. 610-611. Montpellier, June 29, 1919.

INSECTS, ETC.
INJURIOUS
TO VARIOUS
CROPS

During the last two years, when the summers have been very dry, *Botys nubilalis* (= *Pyrausta nubilalis*) has done considerable damage to the maize crops in the Toulouse district. It is a well known fact that the years of greatest drought are those when the attacks of this pest are the severest.

The microlepidopteron has two generations in that region. The moth appears first in June. It is a night-flier, and deposits its eggs at night, laying them not, as is stated by some writers exclusively upon the panicle of the male flowers, but also all along the culm, and especially in the axils of the leaves. The caterpillar, when it emerges, penetrates into the interior of the culm, and eats the central portion. It also does damage to the upper portion of the ear, and eats the caryopses until a fairly advanced stage of maturity is attained. The second generation appeared at the end of August, and the moths lay their eggs by preference at the base of the culms. The later caterpillars do the same amount of injury as those of the first generation. *Pyrausta nubilalis* does not pupate until the end of May; it makes no special kind of cocoon. Pupation takes place in the cavities made by the caterpillar, and not in the soil.

At the harvest, many caterpillars are carried away with the dry maize stalks which are fed to animals as fodder; a considerable number, however, stay at the base of the stubble. This decomposes very slowly thus forming an excellent shelter for the microlepidopteron.

The *Pyrausta* individuals contained by the dry maize stalks fed to animals have every chance of being destroyed by the fermentation taking

place in the manure heap, for the cattle only eat the bracts and leaves, and the rest is thrown away. It is not well to burn this refuse, especially when there is a dearth of fodder.

On the other hand, excellent results should be obtained by uprooting and burning the remainder of the straw, which is usually left on the ground. This can easily be done as it is light work, suitable for women and children, and can be facilitated by making a furrow with the plough under the line of stubble which is to be removed.

Early topping before the moths of the second generation appear has given no results, which proves that the moth does not lay its eggs solely on the male inflorescence.

Late varieties of maize, of which the culm has not grown above the leaves at the time when the moths of the first generation deposit their eggs, are much less attacked than earlier varieties. Thus, summer varieties of maize sown as catch crops were not attacked. The parasite chiefly injures maize crops that have been grown on the same ground for several consecutive years. On one field, which had been under maize for three years, the writer found 60 % of the plants attacked.

A tachinoid dipteron has been found that lays its eggs on the caterpillars of both generations. The larvae of this insect destroyed, in 1918, more than 20 % of the *Pyrausta* caterpillars. It is much the most formidable foe of the "maize pyralid".

1290 - **Root Knot on Soya in the United States.** — See No 1132 of this Review.

1291 - **Cotton Plants with Glabrous Leaves Much Attacked by Aphids in British India**
— See No 1122 of this Review.

1292 - ***Oxycarenus hyalinipennis*, a Rhynchote Attacking Cotton in Angola, Portuguese Africa** (1). — GUERREIRO, BEATRIZ M., in *Republica Portuguesa, Governo Geral da Provincia de Angola, Inspeção de Agricultura, Boletim de Agricultura, Pecuária e Fomento*, Third Series, No. 2, pp 64-66. Loanda, February 1919.

At the beginning of October, 1918, large numbers of *Oxycarenus hyalinipennis* Costa ("persejejo preto do algodão,") appeared in the cotton plantations at Catete. This insect is known to feed upon the seeds of the cotton. It was not, however, found upon the green bolls, but only upon those which were already open and in these the females deposit their eggs. Hence it appears that the best way of checking the attacks of the parasite, would be to gather the crop as soon as is feasible. If the cotton, when harvested, is much infested by the rhynchote, it is advisable to spread it out upon the ground before putting it into sacks in order to allow as many of the insects as possible to escape.

The most efficacious method of controlling the pest is to burn all the old bolls, and to cut down and burn the grass growing near the cotton plantations.

(1) See *R.*, October, 1918, No. 1884. (Ed.)

1293 - **Snails Injurious to *Agave sisalana* in Sicily, Italy.** — See No. 1141 of this Review.

1294 - **Animal Pests of the Castor-Oil Plant (*Ricinus communis*) in Sicily, Italy.** — DE STEFANI, T., in *Bollettino di Studi ed informazioni del R. Giardino Coloniale di Palermo*, Vol. V, Parts 1-2, pp. 39-44. Palermo, 1919.

With the exception of the macrolepidopteron *Caradrina exigua*, an insect rarely attacking the leaves of the castor-oil plant, and never doing them much harm, no other animals had been reported in Sicily as injuring this Euphorbiacea which in that island is a perennial shrub.

In June, 1918, however, Prof. A. Borzi the Director of the Royal Botanical Garden and the Royal Colonial Garden at Palermo noticed that the young castor-oil plants (*R. communis* var. *minor*, and var. *sanguineus*) growing in the Botanical Gardens were looking rather sickly; in fact, their leaves had turned yellow and become a little flaccid. On examining the plants carefully, he found on the lower surfaces of the leaves a large quantity of mites, and a fair number of the small brown larvae of some insect.

The mites were recognised by the author as belonging to the well-known species *Tetranychus telarius* var. *russeolus*; they were particularly numerous on *R. communis* var. *sanguineus*. The brown larvae were those of a predatory beetle, *Stethorus punctillum*, which was doing great execution among the mites in whose company it was found. The adult forms of these larvae were obtained by the author from the middle of June to the beginning of July.

During the latter month, Prof. Borzi also observed that the workers of an ant, which was determined by the author as *Aphaenogaster testaceopilosa* var. *semipolita*, collected and carried to their nests the seeds that had fallen upon the ground from an old castor-oil plant, and at the same time, a rhynchote, identified by the writer as *Brachypelta aterrina*, tried to make its way into the ant-hill across the small heaps of seeds deposited at the entrance. Following the path taken by the workers of this ant, the author discovered under the leaves of an old castor-oil plant, other individuals of the same rhynchote with their rostra on seeds of this Euphorbiacea. He therefore concludes that these insects were sucking the fallen seeds, and that they tried to effect an entrance into the ants' nest in order to feed upon the seeds that had been deposited there. On opening the ant-hill, a fairly large quantity of seeds was found already stored within, and amongst them, were some dozen *Brachypelta* individuals. The writer considers that the rhynchote frequents the ant-hill because the seeds become damp and soft, and begin to germinate there, thus affording a substance which it is easy to reach and suck out; further, the rhynchote probably finds the ant-hill quieter than the open and has a large store of food at its disposal without any fatigue; on the other hand, the ant does not appear to mind this invasion of its nest.

1295 - ***Thamnurgides myristicae* n. sp., Coleopteron Injurious to Nutmegs in Java.** — ROEPKE, W., in *Troubita*, Vol. I, Part. 1, p. 23-29, figs. 7. Batavia, 1919.

A considerable number of a small coleopteron had often been found in freshly gathered nutmegs, but it was not until August, 1908, that the author

received specimens of this insect from Blitar. The planter who had forwarded them for examination reported that the beetle was often met with, and that it also attacked ripening nutmegs while still on the tree. In 1917, and particularly during the dry months of July and August, this insect was present in large numbers in the plantations in the neighbourhood of Salatiga.

During the intervening years, it must have been less plentiful, seeing that it had not attracted much attention from the nutmeg growers, though it appears that they had observed it from time to time as it was known to them under the name of "Pala Bubuk". A. D. HOPKINS of Washington, to whom the author sent some specimens of the beetle, decided that it was a new species of *Thamnurgides* (fam. *Ipidae* syn *Scolytidae*). It is described in the present paper under the name of *Thamn. myristicae*.

The author has not been able to prove the truth of the statement that this insect attacks the fruit while it is still on the tree. It usually develops on the nutmegs lying on the ground, since being softened by humidity they offer no resistance to the attack of the pest, which is able to excavate a large cavity of variable form in the interior of the nutmeg in which it deposits its eggs. In this cavity, which is always situated in the centre of the fruit, are later to be found, not only eggs, but large and small larvae, pupae, colourless adults, and fully developed beetles.

It would appear that several generations, since they are not clearly separated, succeed one another in the same cavity. Some of the adult individuals afterwards leave the nutmegs by means of holes excavated in their walls. In the same cavity made by *Thamn. myristicae* were found many mites, the latter apparently living as parasites upon the coleopteron. The writer noticed that colonies of *Thamn. myristicae* which were much infested by these mites were doomed to destruction. Young adults not yet having acquired their definite colour seem to be especially susceptible to the attacks of the parasite. Masses of them, either dead or attacked by the fungus, are to be found in the spoilt nutmegs.

1296 - **Unknown Corpuscles Observed in Diseased Spinach Roots in Holland.** - SCHÖNERS, T. A. C., in *Mededeelingen van de Landbouwhoogeschool en van de daaraan verbonden Instituten*, Vol. XV, Part 2, pp. 75-84, 1 pl. Wageningen, 1918.

In March, 1918, there arrived at the Wageningen Phytopathological Institute, some diseased spinach plants, of which the principal roots were black or brown in colour, and appeared shrivelled. The rootlets were either affected in a similar manner, or else entirely absent.

In the discoloured areas, there was no trace of any mycelium, except in one or two of the 40 or 50 specimens examined. In all cases, however, the writer found in the root parenchyma, fusiform, more or less oval corpuscles containing larger or smaller fat globules; these corpuscles measured $15 \times 5 \mu$. Some of the root cells, and even the root-hairs, were literally filled with these bodies, which, however, were very rare in the vascular bundles.

The cell walls appeared to be intact, but as soon as they were

dead, they began to decompose. The author distinctly, but very seldom, observed the corpuscles in motion; that they do move, has been confirmed by other investigators.

Although it may well be that these bodies move by their own efforts, still it is possible that the movements are due to the very mobile bacteria which have sometimes been seen near to these unknown corpuscles and might impel the latter from one spot to another.

The corpuscles have been examined by several biologists and botanists, who, however, have not succeeded in determining their real nature. Attempts to cultivate these bodies in artificial media outside the host plant have only afforded negative results. No better success was obtained from direct experiments carried out for the purpose of determining the parasitic nature of these corpuscles and their capability of infecting.

Although he is unable to prove his assertions by tangible proofs, the author is inclined to believe that the bodies in question — which he proposes to call provisionally X organisms, and which he observed for the first time in 1917 in the roots of haricot beans that were affected similarly to the spinach — are a hitherto undescribed form of protozoon.

1297 - *Pegomyia calypttrata* and *P. affinis*, Diptera Parasitic on *Rumex* spp. in the United States. — PROST, S. W., in *Journal of Agricultural Research*, Vol. XVI, No. 9, pp. 229-243, 1 fig., 3 pl., Washington, D. C., 1919.

The life-history and habits of two leaf-mining species of *Pegomyia* whose larvae attack the leaves of *Rumex* spp.

P. calypttrata Zett., which is rare in Europe (Sweden, Germany), occurs commonly throughout the United States (States of New York, Washington, Minnesota, Illinois, Pennsylvania, Massachusetts, and New Jersey). It lives on *Rumex obtusifolius*, *R. crispus* and *R. acetosa*.

From puparia of *P. calypttrata* the writer reared two parasites:—*Opius quebecensis* Prov., and *Dacnusa scaptomyzae* Gahan. A third parasite was reared from the eggs of *Pegomyia* and determined as *Trichogramma minutum* Riley. The larvae are also attacked by the adult and nymph of a predacious insect, *Nabis ferus* (L.).

Pegomyia affinis Stein is a less common species in the United States than *P. calypttrata* but has been mentioned as occurring in the States of Pennsylvania, Vermont, Illinois, and New York. It lives on *R. crispus* and *R. obtusifolius* and probably also attacks other species of *Rumex*.

1298 - *Labidostomis hordei*, a Beetle Injurious to the Vine in Morocco. — VAYS-SIÈRE, P., in *Bulletin de la Société entomologique de France*, No. 10, pp. 910-911, Paris, 1919.

In April, 1919, the author noticed that the buds of the native vines in a two-year-old vineyard at Meknès (Morocco) had been eaten away by the chrysomelid beetle *Labidostomis hordii* F., the vines being so severely injured that few of them were capable of making new buds. On the other hand, the varieties imported from France, which formed about half of the vineyard, had up to that time remained immune.

The habits of *Lab. hordei* are at present but imperfectly known; it is only certain that it habitually confines itself to pastures, or to the edges of crops, where it lives on low-growing plants. So far, it had never been seen on the vine.

The best practical method of controlling the parasite is by spraying the young vine buds with an arsenical solution.

1299 - *Nephantis serinopa*, a Microlepidopteron Injurious to the Coconut Palm in Travancore, British India. — PILLAI, R. M., in the *Agricultural Journal of India*, Vol. XIV, Part, 4, pp. 668-669, 2 pl. Calcutta, July, 1919.

An attack of *Nephantis serinopa* Meyr. on *Cocos nucifera* in Quilon and the adjacent areas was reported towards the end of May, 1918. On inquiry, it was found that the outbreak of this pest had commenced nearly a year before on a few palms in a cemetery, and that in the course of a year it had attacked more than 9000 palms.

The affected trees looked faded, as if they had suffered from a severe drought, and the leaves, especially the mature ones, dried. In extreme cases the palms died of the attack. In ordinary cases, the health as well as the yielding capacity of the trees suffered, and the latter took more than a year to regain their normal condition. The microlepidopteron completes its life-history on the host-plant. The eggs are found on the damaged leaves. The larva can be seen all the year round, it makes a gallery on the lower surface of the pinnae. The moth is attracted to light. The pest is new to Travancore.

Young trees have been treated successfully by means of spraying them with contact poisons, and poisonous substances acting upon the stomach of the insect. The process of cutting and burning the affected leaves has a decided effect in keeping the insect in check. More than 3888 trees were treated and nearly 24 2½ leaves were cut and burned.

1300 - *Hidari irava*, a Macrolepidopteron Attacking the Coconut Palm in the Dutch Indies. — IJEFMANS, S., in *Mededeelingen van het Laboratorium voor Plantenziekten*, No 35, pp 15-31, 1 pl. Batavia 1919

The macrolepidopteron *Hidari irava* Moore has often been reported in the Dutch Indies (Java, Sumatra, Bali) as an enemy of the coconut palm. In some cases, the damage done by it has been considerable. For this reason, the author undertook the study of the life-history and parasites of this insect.

When the caterpillars are numerous, the larger veins are all that remains of the pinnae attacked by them. They join together the leaf segments in a typical manner by means of a silky network, and hide themselves in the refuges thus constructed. These larvae have also social habits.

Metroxylon Sagu and *Cocos nucifera* are mentioned in the literature as the host of *Hidari irava*. The author, however, found the larvae only upon the coconut palm and another palm probably belonging to the genus *Livistona*. Feeding experiments have shown that these caterpillars readily

eat the leaves of the coconut palm and of *Arenga*, but will hardly touch those of *Metroxylon*, if they have the liberty of choice.

The author gives a description of the various stages of development of the insect.

The egg-stage lasts from 8-9 days. In captivity, the female only lays 44 eggs, but no doubt, the number produced is much greater under normal conditions. The larval stage lasts from 32 to 37 days. The chrysalis stage occupies from 10 to 12 days. One generation can develop in from 50 to 57 days. The adult insect is distinctly an evening flier.

At Padang (Sumatra), a tachnid, a braconid, a chalcidid, and an ophonid have all been found to be parasites of *Hidari irava*. There seems also to be a parasite which attacks its eggs. The tachnid and the braconid are its principal enemies. The braconid is, in its turn, infested by a parasite. From each of the braconid cocoons kept under observation, two specimens of the hyper-parasite were obtained which, however, is somewhat rare. The braconid, on the contrary, is well represented: from a single caterpillar of *H. irava* 122 braconid individuals were obtained.

For the control of the macrolepidopteron, the author advises picking off the caterpillars by hand, the use of sprays, and the protection and propagation of its parasites. Small coconut palms can be freed from the insect by removing the caterpillars by hand, and by spraying. A very efficacious mixture for the latter purpose consists of 1/100 Paris green and 5% lead arsenate in water. This mixture does not burn the leaves.

1301 - *Bronthispa froggatti* (?), a Coleopteron Injurious to the Coconut Palm in Sumatra and Java. — LEEFMANS, S.,¹ in *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 35, pp. 1-4, 3 pl. Batavia, 1919.

On the west coast of Sumatra (at Padang), and in the west of Java, the foliage of coconut palms of 4 years of age suffers greatly from the attacks of the larvae and adult forms of *Bronthispa froggatti* Sharp (1) or of some very similar species. The author never observed any injury to older trees. He considers that the damage done by the beetles and their larvae is much aggravated by the presence of the fungus *Pestalozzia Palmarum*, which appears to be able to penetrate into the leaf tissues by means of the wounds caused by the insect. The writer describes the different stages of the life-cycle of this *Bronthispa*.

Sometimes, the eggs hatch out after from 7-10 days, but usually not before 8-9 days. The larval condition lasts 31-38 days; the pupal stage 7-9 days. Under laboratory and cultural conditions, 52 days elapse on an average between the deposition of the egg and the emergence of the adult insect from the pupa. The adults live a very long time (6-8 months under laboratory conditions). The largest number of eggs deposited was 93 in 6 months.

At Padang, many of the eggs are infested (62%) with a chalcidid parasite, which takes 16-17 days to develop. From each *Bronthispa* egg a single chalcidid individual emerges.

(1) See R., Jan., 1915, No. 103. (Ed.).

Repeated experiments, undertaken with a view to controlling the coleopteron, have proved that the best way of killing both the adults and the larvae, is to spray the young coconut palms with a 2 % solution of lead arsenate. All trees thus treated remain immune for at least two months.

As a preventive measure, it is well to spray the young trees in the nursery with the same solution before planting them out.

1302 - *Zeugophora scutellaris* Suffr., a Coleopteron Injurious to *Populus deltoides* in New Jersey, United States. — WEISS, H. B. and NICOLAY, A. S., in *Entomological News*, Vol. XXX, No. 5, pp 134-127, 1 fig. Philadelphia, May, 1919.

Zeugophora scutellaris Suffr., a Chrysomelid not hitherto recorded in New Jersey, was first observed in a nursery at Arlington, on June 23, 1918, where it was feeding on the foliage of *Populus deltoides*.

It is a European species, which also appears to be widely distributed in the United States (New Mexico, Illinois, and Indiana).

In New Jersey, the adult beetles were very numerous during the last week of June; they preferred feeding on the terminal leaves of which the lower surface was destroyed, the upper surface and all the veins being untouched. Later, the upper leaf tissue and the veins dry and break, leaving irregular holes.

Eggs are deposited on the leaves and the larvae mine the tissues during July. By the first week in August, many of the larvae are full-grown. They then leave the mines, and drop to the ground, where pupation takes place, probably during the spring. The adults appear in the early part of the next summer.

The combined action of the adults and the larvae produces injuries that kill the foliage completely, most of it drying and falling to the ground. At Arlington, the infestation was so severe that practically every leaf of four or five medium-sized trees was attacked.

The life-history and habits of *Zeugophora scutellaris* are similar to those of *Z. flavicollis*, which is reported by KALTENBACH as injurious to *P. nigra* in Sweden and Germany.

The authors give descriptions of the egg, the fully-grown larva, and the adult form of *Z. scutellaris*.

1303 - The European Elm Sawfly Leaf-Miner (*Kaliosysphingia ulmi*), a Hymenopteron Attacking Elms in Ontario, Canada. — CRYSTAL, R. N., in *The Agricultural Gazette of Canada*, Vol. VI, No. 8, pp. 725-738, 1 fig. Ottawa, August, 1919.

The presence in Canada of *Kaliosysphingia ulmi*, Sund a hymenopteron of European origin belonging to the family of the *Tenthredinidae*, was first discovered in July, 1915, in the neighbourhood of Kingston. The insect was again observed on June 10, 1919. A recent investigation made by the author for the purpose of ascertaining the extent of the damage being done by this pest in the city of Kingston and its environs, has revealed the presence of the insect in a few localities, mainly on *Ulmus glabra* Huds. var. *Camperdownii* Rehd, for *R. Americana* L. is not attacked.

The foliage is injured by the eating away of the inner parenchymatous tissue of the leaf by the numerous larvae. Each larva starts an individual

mine, but as the cavities become larger, they unite and the entire leaf surface becomes blotched and blistered. The work of the miner becomes most conspicuous in June. The leaves in which a large number of larvae have been working turn brown and wither. In the case of two medium-sized elms (*U. campestris*) at Collin's Bay, Ontario, the whole tree was affected, the foliage assuming a brownish-red colour with the appearance of having been scorched by fire. *U. glabra* and *U. campestris* are apparently the most liable to severe infestation.

For the control of the elm sawfly leaf-miner, spraying with a tobacco extract containing nicotine sulphate and soap is recommended. Kerosene emulsion has also proved effective. The spraying must be done in June, as soon as the tiny mines appear in the leaves, and the upper and under surfaces of the latter should be thoroughly coated.

Prof. SLINGERLAND has also employed a cultural method of control. Since pupation takes place within an inch from the surface of the soil, and the adults cannot emerge from cocoons at a greater depth, he recommends the removal in the spring of a thin layer of soil from below infested trees which should be buried without delay at a depth of over six inches below the surface. The operations should be concluded before May 1.

The author gives descriptions of the larva and of the adult sawfly and also information respecting the biology of the insect.

1304 - *Chrysobothris tranquebarica*, a Coleopteron Injuring *Casuarina equisetifolia* in Southern Florida. — SNYDER, T. E., in *Journal of Agricultural Research*, Vol. XVI, No. 6, pp. 155-163, 2 figs., 4 pl. Washington, D. C., 1919.

In April, 1916, for the first time, serious injury was reported to have been done to young trees of *Casuarina equisetifolium* Forster, a species much cultivated in Southern Florida, by a buprestid beetle identified as *Chrysobothris tranquebarica* Gmel. (the mangrove-borer).

The investigations of the author resulted in the discovery that this insect was a common and destructive enemy of the red mangrove (*Rhizophora Mangle* L.), whence it had spread to the casuarina trees.

The beetle only attacks these two species of tree when they are alive. Small *Casuarina* trees are, as a rule, injured near the base; individuals over three years of age are usually not attacked, except as regards the tops or branches.

The adult insects feed on the tender succulent bark of their host. The eggs are laid in little crevices under loose bark, usually in the middle trunk. The young, as soon as they are hatched, bore through the cambium to the surface of the wood, and as they feed on the cambium and grow, they extend their burrows horizontally, spirally, or longitudinally. When full-grown the larva bores into the wood to a considerable depth, and excavates its pupal cell. It also excavates a hole for the exit of the beetle; this runs from the pupal cell to, or near to the surface.

Many *Casuarina* and *Rhizophora* trees have died from the attacks of *Chrysobothris*.

Though the latter has numerous natural enemies they are not sufficient

to control it. Among its predatory foes are two birds *Colaptes auratus* and *Melanerpes erythrocephalus*, the larvae of the beetles *Tenobroides* sp. and *Adelocera* sp. Two species of hymenopterous parasites also attack the mangrove-borer, *Atanycolus rugosiventris* Ashmead, and *A. labena* n. sp.

All badly damaged *Casuarina* trees should be cut and burnt between September and March in order to kill the insects before they emerge. The trees may be entirely removed, cut off near the ground, or merely topped, according to what the circumstances require. Since the borer usually attacks the young trees near the base, care should be exercised that no infested stumps remain. Trees only slightly damaged and showing evidence of quick recovery should not be cut. Young *Casuarina* trees growing in proximity of mangrove swamps, or near other infected *Casuarinas*, should be examined carefully in September and March, and the young larvae of the beetle killed by spraying the affected portion of the trunk with poisoned kerosene emulsion containing sodium arsenite and made in accordance with J. C. CRAIGHEAD'S formula.

From April to June, when large numbers of the adult beetles are flying about and feeding on the trunk, they should be killed by the use of the same emulsion.

No pruning of *Casuarina* trees should be attempted between April and August, since the consequent flow of sap would attract the adult coleoptera to the trees. Mangrove stakes ought not to be employed to support young trees, as they attract the larvae of *Chrys. tranquebarica*.

1305 - *Thaumetopoea (Cnethocampa) processionea*, Injurious to Cork Oaks in Morocco. — CHAINE, J., in *Bulletin de la Société d'étude et de vulgarisation de la Zoologie agricole*, Year XVIII, No. 7, pp. 67-67. Bordeaux, July, 1919.

Towards the end of June, 1918, while crossing the Forest of Mamor (West Morocco), the author noticed the great damage done to the cork oaks by the caterpillars of *Thaumetopoea (Cnethocampa) processionea*. For more than 5 km. along his line of route, and for a depth of about 10 km., these trees were completely stripped. Such destruction is of frequent occurrence, but the cork oaks are usually attacked now in one zone, and now in another of the immense forest, and it is rare that the affected area is so extensive. All the trees stripped in June by the "processional bombyx of the oak" were attacked within a fortnight at the longest. Hitherto, no measures have been taken for the control of this macrolepidopteron.

[1304-1305]

